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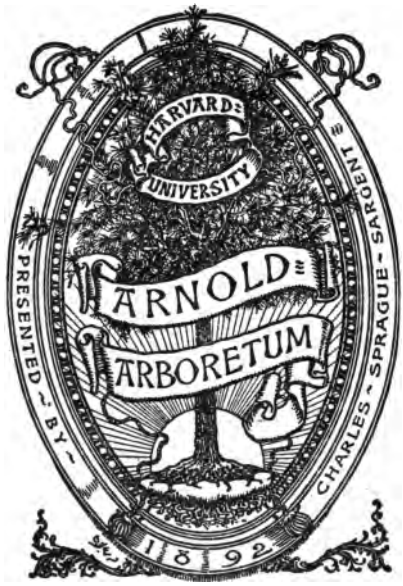

DEPOSITED AT THE HARVARD FOREST 1943
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TRANSVAAL

FOREST REPORT

BY

D. E. HUTCHINS, F.R. Met. Soc.,

Conservator of Forests,

Capetown.

PRETORIA:

PRINTED AT THE GOVERNMENT PRINTING AND STATIONERY OFFICE.

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PREFACE.

I arrived in Pretoria on August 3rd, having on the way seen some of the timber plantations near Johannesburg. On the 4th I had an interview with Lord Milner at Johannesburg. On the 5th I left on a tour through Ermelo and the New Scotland District, returning *via* Lake Chrissie, Pan, Middelburg, and the Delagoa Bay Line.

Various sites for plantations were selected, and it being urgent, on account of the lateness of the season, that these plantations should be begun at once, I submitted a preliminary report on the areas selected.

On the 14th August I proceeded to Potchefstroom for the selection of a plantation site there, returning to Pretoria on the 16th. On the 18th, I visited the Groenkloof Plantation, and on the 19th left for Pietersburg and the forest country beyond Woodbush and Haenertsburg, returning to Pretoria on the 27th August. I visited Irene the same day and again the following day regarding arrangements for the proposed central nursery there. Thence I proceeded to Johannesburg, visiting the Meteorological Office and inspecting the trees in the Park, the Lippert Plantation at Braamfontein, and Mr. Hume's Pinetum.

TRANSVAAL FORESTRY REPORT.

PLANTATION SITES SELECTED.

ERMELO.

I visited this in company with the Director of Agriculture, and it was arranged to demarcate out from the town lands 2,000 acres for a timber plantation; in demarcating the plantation ground the depth of soil to be well tested by digging pits to not less than three feet. The rainfall at Ermelo is not such as to allow of good results on shallow soil, which, therefore, as far as possible, must be excluded from the boundaries of the plantation areas. Though a somewhat irregular area will increase the cost of fencing, it will add to the beauty of the plantation (which is an object prized at Ermelo), and an irregular boundary will afford more shelter for stock. The irregular boundary will further have the advantage of allowing the trees more space to draw from the subsoil moisture of the adjoining ground during any time of severe drought.

A good site was selected for a nursery of about 10 acres in extent. The nursery site has a sufficient supply of water and a walled enclosure where the seed tins can find the necessary shelter.

Below the ten acres of the nursery site, ten acres for lucerne or other forage crop to provide for the plantation mules was also selected. This second ten acres is low-lying and well-watered; but somewhat too frosty for nursery purposes.

Rainfall.—According to the returns furnished me at the Meteorological Office in Johannesburg, the mean rainfall at Ermelo amounts to only about 25 inches. I am inclined to think, however, that the actual yearly rainfall is higher, probably 30 inches, in which view Mr. Legat concurs.

The following were the figures given me by the Meteorological Office :—

1896	27 inches
1897	23 ,,
1898	29 ,,
1899	25 ,,
1900	23 ,,
Mean	25.4 inches

Government Farms in the New Scotland District.

There are various farms in the New Scotland District, which, having a favourable rainfall and good soils, should be definitely reserved for forest purposes. The time at my disposal did not permit me to visit more than a portion of these farms. I recommend that the following should now be reserved for forest purposes, and the list be added to as soon as the Forest Department is in a position to make a more detailed inspection:—

Sihanahana, Newcastle, Sunnyside, Umpilusi, Bonnybraes, Usutu, Gem, Rothesay, Ring-kink, Florence.

Os-Hoek and Farms on the Swazie Border.

To examine these farms individually would necessarily require some time, as the ground is precipitous, transport difficult, and the work of the examining officer necessarily slow. The point which can only be settled by a detailed examination is whether the rocky nature of the ground and the inaccessibility of the locality is compensated for by an increased rainfall. With this view the farms should be visited and reported on by a competent Forest Officer as soon as may be. If any large proportion of Os-Hoek and the adjoining farms are found suitable for forest purposes the whole block should be declared demarcated forest, and placed under the Forest Department to be utilised according to circumstances, care being taken that the revenue from grazing permits is not notably less than if the farms had been leased or sold in the ordinary way for grazing purposes. It may be possible to afforest large areas here at little cost with Swazies as "Forest Cultivators" and the natural reproduction of forest trees from small plantations on selected areas of good ground. The whole must of course be fire-protected. This, too, might be done at a cheap rate with a good Resident Forester on the spot, speaking Kaffir, and settled in a house with 20 acres of farm and garden ground to help him to live on a moderate salary, say £150 or £200 per year.

Thus, with the natural reproduction of such hardy trees as pine and wattles, together with the planting done by native forest cultivators, it may be possible to gradually clothe with forest this rugged but well-watered country. It is too inacessible for the expense of regular plantations. From the pamphlet appended it will be seen how the Cluster-pine has spread self-sown in a similar locality in Cape Colony. I attach also a sample of the Forest Cultivators' permits used at the Cape.

Forest Cultivators.—Where there are natives who wish to live in the forest, they can often be turned to account to the great benefit of the forest. The most

successful Teak plantations in India and all the large plantations, with one exception, have been made by Forest Cultivators. In Burmah, the Karens with their "kumri" cultivation have formed extensive Teak plantations for Government at an average cost of only £1 per acre.

In Cape Colony, Forest Cultivators have been frequently utilised when the forest has come in contact with natives. Not only do they do a certain amount of planting at cheap rates, but they form an effective forest police, the white cultivator, or the native cultivator of one sort, being used to protect the forest from other natives. Thus, where Fingoes were destroying the forest, Kaffir cultivators would be put in, or *vice versa*. Again, white or coloured cultivators help to protect the forest from Kaffirs inclined to steal wood, to cut, burn, or otherwise injure the forest. Section 20G. of the Cape Forest Act makes it a penal offence to contravene any of the conditions under which Forest Cultivators are given temporary cultivation permits for reforesting.

GEMSBOKFONTEIN (PAN RAILWAY STATION).

It has, I understand, been decided that this farm should be made the seat of a central forest nursery, and the whole farm planted with timber trees. I trust this work will proceed without delay, so as to save the present season. I attach the following note made at my inspection of the farm :—

Purchased recently at about £1 per acre, between 4,000 and 5,000 acres.

Unsuitability to Agriculture.—A coarse grass predominates, indicating a poor soil. According to Trigg, a settler on the adjoining farm, the soil is too light and poor for successful agriculture, and several intending settlers have visited and condemned it.

A plot of mealies near the railway station might indicate a patch of rather better soil, but here there has been a horse kraal. Airey, an Australian, settled on an adjoining farm, who took me over a portion of Gemsbokfontein, says if ploughed and fallowed it may give one crop of mealies. Afterwards it would require artificial fertilising. The soil-poverty of this farm is attributed to its high-lying situation.

Suitability to Forestry.—The comparative elevation of the farm and its exposed situation would not be entirely unfavourable to forestry. Trees would soon form their own shelter, and they would collect moisture from and be favourably influenced by the mists which form here over

the highlands. The soil, though often poor at the surface, is almost always deep, and I have remarked on its open and sandy character.

Depth and porosity of soil are essential for remunerative timber growth in this climate, with its long dry season and rapid evaporation. The soil generally is a reddish, open, sandy loam, strikingly similar to the soil of the well known Tokai Arboretum near Cape Town. That soil, on analysis, was pronounced poor for agriculture, but now carries a first-rate tree growth.

Water.—There is on Gemsbokfontein a fine spring of running water, evidently, from the temperature, coming from some depth. In quantity this water is about enough for a forest nursery and the growth of forage for the forest animals.

Acquisition of this Farm for Railway Purposes.—The Cape Government Railways have recently purchased a farm at Ceres Road (near Capetown), as part of their scheme of railway sleeper plantations. The Forest Department obtained this farm at a cost of about £1 per acre (for the area suitable to timber), and I do not think much higher than this can be paid for a remunerative timber plantation. £1 per acre was, I understand, the price paid for Gemsbokfontein. A farm as well suited for a railway sleeper plantation might be obtained nearer to Machadodorp, but this seems doubtful, and in view of the fact that about £50,000 is now going yearly out of the country for imported sleepers, or, in other words, that each day's delay costs the country nearly £150, it seems desirable to begin work without delay at Gemsbokfontein. Now is the exact season for seed sowing, and a few weeks delay will mean the loss of a year.

Trees.—There are a few flourishing young trees, Gums, Wattles, and Casuarina at the Pan Railway Station.

MIDDELBURG.

As mentioned in my preliminary report of the 18th ultimo, I visited the town lands at Middelburg, and ascertained that two blocks of about 1,000 acres each could be rendered available for tree planting.

The first of these is situated on the ground occupied by the present encampment of the "Queen's Bays" and the valley below it. The second block is situated below the burgher camp.

The settlement of the actual boundaries of the 2,000 acres on the Middelburg town lands should be proceeded with without delay. There is danger that the ground

may be lost for tree-planting purposes. Already some of the ground formerly selected for tree-planting is now occupied by Kaffir and Asiatic locations.

Belfast.

The time at my disposal did not allow my visiting Belfast, but from the description given me by Captain Johnston I understand that 2,000 acres of the town lands here can be made available for tree-planting. Belfast, as is well known, is on the highest point of the Delagoa Railway, and, being situated so far to the east, must necessarily command a heavy rainfall. I have endeavoured unsuccessfully to procure figures of the rainfall here and on some of the New Scotland farm sites mentioned above. There seems, however, to be an entire absence of rainfall observations, with the exception of those taken by Mr. D Forbes at the farm Athole, near New Amsterdam, on the Swazie border. Mr. Forbes assures me that the average rainfall there is about 40 inches. A favourable feature, too, there is a certain amount of rain in quite early spring. Belfast should share these advantages, and, if the ground on being inspected by a Forest Officer proves favourable, the Belfast site must be looked upon as the best on this list, after Pan.

Potchefstroom.

As mentioned in my report of the 18th ultimo, a large block of ground has been reserved here for timber plantations. I have visited with Mr. Legat, and selected a portion of this block best suited for tree-planting. The same rainfall cannot be expected here as in the Eastern Districts, so that care is necessary in selecting only the best deep open soil. I estimate that the good ground which we have been over represents about 2,000 acres of a deep rich, dark-coloured loam, and about 1,000 acres of a light-coloured loam inclined to be clayey underneath, but where there will be good sub-soil moisture; indeed, the lower portion of this land contains an open well where, even now, at the close of a very dry season, there is an abundant supply of water.

Groenkloof Plantation, Pretoria.

On soil which is generally of a most unpromising nature, an excellent growth has been here obtained of *Eucalyptus tereticornis*. A good fence has recently been erected round the plantation, and the plantation safeguarded against fire by burning off the dangerous grass outside. More care, however, might have been shown in doing this, as on one side some young Casuarina has

been burnt. I considered the question whether it was worth while retaining the Casuarina that has not been burnt, and on the whole am inclined to the opinion that it would be better to abandon it. Its general appearance is unhealthy, and the growth poor, a result similar to what I have seen where *Casuarina leptoclada* has been planted elsewhere in the Transvaal in pure plantations. It is somewhat curious that this tree should succeed so well with a little care under garden cultivation and yet generally fail as a plantation tree, when planted on the veld. The cause is probably climatic. My recommendation as regards the Groenkloof plantation is that it should be completed with the trees left on hand each year from the neighbouring Irene Nursery.

There is some good soil here for general planting, and the poor stoney ground can be planted with *Eucalyptus tereticornis* and the Iron-barks (*E. sideroxylon* and *E. paniculata*), with a little *E. siderophloia* and *E. crebra*.

This plantation, so near the Pretoria market, will give a good return in branch wood for firewood and in timber for street-paving and general purposes. The adoption of wood-paving would get rid of the pestilent dust which is now so unpleasant a feature in the Transvaal towns, but particularly in Johannesburg and Pretoria.

LICHTENBURG.

The rainfall here is not known. It is probably not above 20 inches, and may be less, so that it will be necessary to proceed with caution, planting only dry country trees, such as Callitrisses, Iron-barks, *Eucalyptus polyanthemos*, *E. tereticornis*, *E. rostrata*, etc. It must be borne in mind that though 20 inches may be enough for avenue trees and scattered trees, it is too little for trees in masses. At Johannesburg the rainfall is 30 inches, at Vereeniging, 25 inches; both of these plantations show the effects of drought, particularly Johannesburg (Braamfontein), where, although the rainfall is greater, the trees are older. As an approximation, the trees at Braamfontein may be averaged at two-thirds the growth of that at Tokai, near Capetown, where the rainfall is 40 inches.

If the rainfall be below 20 inches, as seems possible, in view of the nearness of Lichtenburg to the Bechuanaland frontier, it will be prudent to reduce the work to a distributing nursery, and such planting as may be necessary for arboretum purposes. At Hanover, in Cape Colony, where, owing to the higher latitude, rainfall counts for more than in Lichtenburg, a plantation was established eight years ago. The mean rainfall there is 15 inches. The severe drought of the past year has compelled the

abandonment of the plantation, and the reduction of the work to a nursery and arboretum, the nursery being to supply trees to farmers and the arboretum to show the growth of trees in the locality.

PLANTATIONS.

Cost, Area, and Yield.

Area.—Timber plantations should not be less than 2,000 acres to be economically managed, and economy is increased if they are larger. The three large plantations near Capetown, at Tokai, Uitvlugt, and Ceres Road, are each about 6,000 acres in area. If a plantation be less than 2,000 acres there is not sufficient work on it for the man in charge to earn his salary, and the cost of fencing and of supervision becomes unduly raised.

The completed area of timber planting in Cape Colony is now over 20,000 acres.

In Natal there are as yet no Government timber plantations, but there is an area of about 5,000 acres of private timber planting (of which more than half is Blue gum), and 25,000 acres of Black wattle *Acacia decurrens.* The Natal wattle plantations yields firewood, pit-props, and nearly £100,000 worth yearly of bark, most of this being exported to Germany and Russia.

Cost of Plantations.—I estimate the cost of planting in the Transvaal under normal conditions to be the same as Cape Colony, viz., about £12 per acre for areas stocked with nursery plants, and £6 or £8 for areas stocked by sowings. The cost of white labour is higher than in Cape Colony; of Kaffir labour, less.

The first year's working of the railway sleeper plantations in Cape Colony has given the following results:—1,251 acres have been planted, and 33 acres prepared for planting at a total cost (exclusive of buildings) of £7 7s. 10d. per acre.

The average cost of the Natal wattle plantations is stated at £6 per acre.

Sowings may be taken at £4 per acre in a good cattle country where the cost of ploughing is moderate.

We have thus £8 per acre as an average for the cost of timber plantations in the Transvaal.

Yield of Plantations.—The yield in money of a timber plantation will naturally depend on its accessibility, rainfall, and soil. Presuming that all these three are favourable, and assuming a mean yearly acre increment of 150 cubic feet, worth 1s. per cubic foot, we have at 50 years a yield per acre of:—

150 x 50 shillings equals £375.

We have taken the mean cost per acre as £8. In 50 years, reckoning compound interest at 3 per cent., the cost per acre becomes £32, assuming that revenue from thinnings covers cost of upkeep, so that Government can then make a small profit and supply timber to the country at one-tenth of what it now costs imported 6,000 or 7,000 miles from abroad.

The plantations will yield, at first firewood, then poles and mine-props, then sleepers, and lastly house-building timber. For mine-props and sleepers the figures are about twice as favourable as in the case of house-building and general timber. This I have assumed to be worth 1s. per cubic foot manufactured, but all the South African Railways have for many years paid for their sleepers at the rate of 2s. per cubic foot. At this rate, if a railway sleeper plantation makes timber at the rate of only 150 cubic feet per acre per year, I estimate that the revenue yielded each year will equal the original first cost of planting!

It may be mentioned that a profit of £4,000 was made on the first timber crop (Blue gum) cut from the Worcester Plantation, 60 acres, in Cape Colony. This was cut at 16 years for pit props. The large timber plantations at Tokai and Ceres Road, near Capetown, have now arrived at this stage :—Their revenue and expenditure are nearly equal, while the main timber crop is as yet untouched. Their revenue is derived from the sale of young trees, seed, and thinnings, furnishing firewood and poles.

It is not generally realised what large returns are to be expected from Eucalypt plantations in these latitudes. It will be possible, at no unreasonable expenditure, to supply the world with wood fuel from Eucalypt plantations. The following is an extract from a recent note in *Nature* on this point, March 20th, 1902 :—

As far back as 1882 the discovery was made by Sir D. Brandis and myself that Eucalypts planted on tropical mountains will produce wood fuel at the rate of 20 tons (dry weight at 60 lbs. per cubic foot) per acre per year in perpetuity. The Eucalypt plantation reproduces itself when cut without further expense, and its dry timber, heavier than coal (which, as met with commercially, weighs 50 lbs. to 52 lbs. the cubic foot), has an equal or a higher thermal power, bulk for bulk, than coal. We obtained this result as the maximum yield of *Eucalyptus globulus* on the Nilgiris, Southern India. No doubt there are other instances where higher yields are produced now, and no doubt also when the coal supply is exhausted selection and experiment will produce a forest vegetation that will produce more than 20 tons per acre per year.

The Sugar beet and all the fruits and vegetables of civilisation show how the vegetable kingdom can be moulded to suit man's wants. If a chance tree on a chance mountain in a chance soil can produce the equivalent of 20 tons of coal per acre per year, it seems not unreasonable to suppose that by selection we can produce, say, double this, or 40 tons. To produce this in perpetuity we should probably have to find a tree with the moderate soil requirements of the Conifers. A powerful sun, a heavy rainfall, and a very rapid forced growth would be the essentials of such a production of wood fuel.

Looking at the rainfall map of the world, one sees that these conditions are fulfilled over about 8,000 million acres of its surface (which is between one-fourth and one-fifth of the total land-surface of 35,200 million acres). I take latitudes below 40 degrees and rainfalls above 40 inches. One half of this area under forest might yield the equivalent of 161,000 million tons of coal yearly. This is more than 288 times the world's present consumption of coal, assuming that coal and Eucalypt timber are of approximately equal heating power. On the basis of the actual forest yields of to-day we have half this, or 80,500 million tons. In Germany, however, not one-half, but one-fourth of the total area is under forest, and this is held on the highest authority to be the suitable protection for a thickly peopled civilised country such as Germany. The forest should properly occupy a higher proportion in countries where large areas are pestilential and unsuited for human habitation. Putting this, however, aside, and taking the German standard of one-fourth forest, then on the basis of to-day's maximum yields, we should obtain a yearly output of 40,250 million tons. And if to convert the maximum forest yield to an average forest yield, we again divide by two, we obtain 20,125 million tons. Lower than this I do not think we can reasonably go for the class of forest under consideration. *It is a little more than thirty times the world's present consumption of coal!*

"The world's yearly output of coal recently was 663 million tons," says Professor Perry.

Thus we see that the yield of firewood from the world's tropical and extra-tropical forests, whenever they are fully stocked and scientifically worked, will yield the equivalent of from 30 times to 122 times the present consumption of coal, or even up to 243 times the present consumption of coal if we succeed by cultivation in doubling present timber yield figures.

It may be objected that my figures are far in excess of those representing the yield of European forests, and that they require confirmation. No doubt they are far

in excess of European figures, but so also is the intensity of the vegetative processes in these latitudes, and so also is the stature of the Sequoias of California and the Eucalypts of Australia and South Africa above the stature of the biggest Spruces and Silver-firs of Europe. The Nilgiri figures I have quoted above were formally recorded in two official reports printed and published by the Madras Government in 1882. They have since been confirmed by the measurements of forest officers who have subsequently had charge of the Nilgiri plantations. Similar figures have been obtained by myself and other forest officers in South Africa. They have been exceeded in several plantations in Natal, while at Johannesburg they have not been confined to Eucalypts, but have been obtained from Acacia decurrens, or Black-wattle, as well as from some other trees.

Therefore, "when our coal supply is exhausted, when all the races of the world have fought for the waterfalls and places of high tide," there will still remain that which Englishmen of all the civilised races of the world do most neglect—the forest.

INDIGENOUS FOREST—NORTH-EAST TRANSVAAL.

In the North-East of the Transvaal, nearly under the Tropic, is the Wood-Bush Range, clothed with a large area of the indigenous evergreen forest of South Africa. This forest, beginning in the gorges of Table Mountain, is found at intervals along the southern coast of Cape Colony to Knysna, a mountainous, well-watered country, where the forest occupies an area of 90,818 acres. The forest reappears on the Amatolas, north of Kingwilliamstown, here between 2,000 and 3,000 feet above the sea level. Then it continues, at intervals, through the Transvaal, Natal, and Zululand, in Natal occupying the slopes of the Drakensberg and the central best-watered portion of the country. It was a surprise to me to find it again so little changed in the North-East of the Transvaal. The existence of this high timber forest in the Transvaal is not generally known. In the "Cape Flora" volume last issued from Kew, plants collected here are shown as belonging to the Kalahari region!

As the forest belt extends northwards it is found at gradually increasing elevations, altitude compensating for latitude. I believe the forest of the North-East of the Transvaal marks its end. To the north of this is the great valley of the Limpopo, and further north the lower country and the quite different forest of Rhodesia. Thus

we have a parallel here to the forest flora of Europe, which terminates, not at the Mediterranean, but on the Atlas Mountains overlooking the Sahara.

Going from Capetown to the North-East of the Transvaal, while the forest preserves its general character unchanged, and also its chief species, some change in the species of timber trees occurs. The first marked change is after passing the Gouritz River, on the Southern Coast of Cape Colony, that is to say, in passing from predominant winter to predominant summer rains. Climatically, the indigenous forest belt of South Africa has rain or mist, more or less, all through the year. At Knysna, where it is first well developed, summer and winter rains are equal. In the North-East of the Transvaal, though there is little actual rain in winter, there is much mist, and at the end of the dry winter season I found the country showing abundant evidence of moisture; Sphagnum moss, tree ferns, and orchids abounded, and there was no appearance of dryness in the ground. Two days before my arrival at the end of August, there had been heavy rain and dense mist. To this climatic similarity is probably due the fact that there is so little alteration in the species extending over such a wide range of country as from Capetown to the Tropic. I noticed, however, the following timber trees, which are not seen in the forest country at Knysna :—

Trichilia emetica.

Valbosch.—This tree is preferred to Assagai for spokes in the Wood-Bush Range.

Eugenia Cordata—Waterwood.—This is one of the commonest and largest trees in the Wood-Bush Range. It is used only for furniture.

Vaterland's Wilge.—This, Waterwood, and Wild-lemon are the most abundant trees at the higher elevations. The young leaves are reddish and aromatic, the fruit terminal winged.

Wild Quince.—A white wood, sometimes cut into planks.

Pygeum Africanum—Red Stink Wood or Bitter Almond.—A strong, coarse-grained, hard timber, useful as a wagon wood. It is said to grow quickly, attaining 20 feet in three years. This tree is first seen in Cape Colony when the summer rains become predominant on the Amatolas.

I noticed the following Cape timber trees in the forest :—

Scolopia zeyheri (Harvey).—Thorn-pear.
Scolopia ecklonii (Harvey).—Red-pear.

Xylosma monospora (Harvey).—Wild lemon, abundant.
Trimeria alnifolia (Planchon).—Wild mulberry.
Kiggelaria africana (Linnaeus).—Wild peach.
Calodendron capense (Thunberg).—Wild chestnut.
Zanthoxylon capense (Harvey).—Knobwood.
Todalia lanceolata (Lamarck).—White-ironwood, abundant.
Ochna arborea (Burchell).—Redwood or Cape plane.
Apodytes dimidiata (Meyer).—White-pear, common.
Elæodendron croceum (De Candolle).—Saffraan.
Hippobromus alata (Ecklon and Zeyher).—Paardepis.
Pteroxylon utile (Ecklon and Zeyher).—Sneezewood.
Trichocladus crinitus (Persoon).—Onderbosch.
Olinia cymosa (Thunberg).—Hard pear.
Cussonia sp., Cabbage tree.—Abundant.
Curtisia faginea (Aiton).—Assagai.
Gardenia rothmania (Linnaeus).—Wilde katjepiering.
Myrsine melanophleos (Brown).—Boekenhout, abundant.
Olea laurifolia (Lamarck).—Black-ironwood, common.
Buddlea salviaefolia (Lamarck).—Saliehout.
Halleria lucida (Linnæus).—Wild Fuchsia, abundant.
Ocotea bullata (Meyer).—Stinkwood.
Celtis rhamnifolia (Presl.).—Kamdabu-stinkwood.
Ficus Natalensis.—Natal fig.
Podocarpus elongata (L'Heritjer).—Outeniqua or Bastard Yellow-wood.
Podocarpus thunbergii (Hooker).—Upright Yellow-wood.

FOREST AREAS.

Till the demarcations are complete it is difficult to say what is the actual area of the indigenous forest of the Transvaal, and what the area of the forest reserves in which it should be included.

On the Wood-Bush Range the main forest is divided into two blocks, of which the larger is called "Groot Bosch" and the smaller "Hells Bosch."

Groot Bosch.—It took our party about 2½ hours, say eight miles, to ride through Groot Bosch in one direction, along the main ridge. Looking over the forest from Pypkop, it appears to be about as broad as long. This would make it about 49 square miles. I am inclined to the opinion, however, that some of this forest has been cut off by farms, for Mr. Jonas scaling off the area between the farms on the plan made it only 12½ square miles.

Hells Bosch.—The area of the farm called Hells Bosch is only 6,000 acres. The actual area of the forest, which is somewhat scattered and distributed over several farms, appears to be nearly equal to Groot Bosch; that is to say, the actual area of the main forest on the Wood Bush Range must be taken to be from 40 to 80 square miles in extent. We may take 50 square miles as the nearest safe approximation at present attainable of the area of the Main forest.

Going from the Wood-Bush Range to Haenertsberg, the forest becomes patchy, assuming the character of the stunted "shola" forest of the Nilgiris, in the South of India: and at other times, even in small detached forests, presenting timber of large dimensions.

There are two such patches of forest near Haenertsburg, one of these being 50 and the other 60 acres in extent. I went through the forest also on the slopes of Volkberg, some of this lying as high as 7,000 feet. Eastward of this I heard of a block of forest of 600 acres beyond Banket Poort, and also of good forest on the further Volkberg Mountain.

Approximately I reckon the forest in the neighbourhood of Wood Bush and Haenertsburg as follows:—

	Square Miles.
Main Forest (Groot Bosch and Hells Bosch)	50
Small detached forest (Wood Bush Range)..	15
Forest beyond Banket Poort..	1
Patchy forest on Drakensberg Range ..	9
Total	75

75 square miles equals 48,000 acres.

It should be determined, at an early date, how much of this is hopelessly alienated, and how much is on occupation farms capable of redemption. Amongst the officials whom I was able to converse with on the subject, there seemed to be a difference of opinion as to the terms on which the forest on occupation farms could be redeemed. It is, I need not say, a matter of grave importance to set this question at rest without delay.

QUALITY AND CAPABILITIES OF THE FOREST.

All this forest that could be reached has been cut out years ago by the old Boers. During our first day, going through the centre of the Main forest, along the main ridge, we did not see a single tree containing any merchantable timber, nor was I long enough in the forest

to catch more than glimpses of the inaccessible unworkable parts. I was informed, however ,that trees of large size had been cut here not many years ago, and I obtained abundant evidence in the stumps and remains of these large trees, the saw-pits, and paths, that timber of large dimensions has been worked from this forest for many years. Smith, the woodcutter at Hells-Bosch, showed me a place where he had cut a Yellow-wood tree ten years ago 32 inches in diameter and 100 feet bole. I understand that when the Transvaal was first settled, all the old farmsteads, as in Cape Colony, were built of Yellow-wood. Stinkwood supplied the furniture, and Assagai, Stinkwood, White-pear, Hard-pear, and Ironwood, the wagon wood used. In the early days there would be more wagon wood cut than house wood. These wagons travelled all over the country up to Equatorial Africa. Then followed the opening of Johannesburg; and then, previous to the making of the railway, a period of great activity in the forest. I heard of a hundred wood-cutters working in the Main forest, each with several Kaffirs under him. Every piece of wood that could be cut was taken away to the mines, or for the houses and wagons required in abundance when the gold fields first opened.

Thus the forest rapidly became exhausted, especially as the work was done without supervision and control, and irregular work was followed, as in Cape Colony, by forest fires. With the opening of the railway to Johannesburg, the prices of wood fell, and the forest has since remained scarcely worked, and is gradually in this favourable climate re-asserting itself. The re-growth and young trees appear to be more abundant at the lower elevations. I noticed most in Pennyfather's Bush, near Haenertsburg.

It is impossible to say, without further inspection, what quantity of mature timber could now be got out of this forest by making roads to those portions which had been protected by their inaccessibility. As far as one can judge from a passing inspection, there is a valley near the site selected for the forest station at Groot Bosch where, by making an inexpensive road, a considerable area of mature timber could be rendered available for work. That is to say, a "Section" should be marked here, and the forest opened to systematic working. In this Section all the mature trees, and all the trees which will not increase decidedly in value during the next twenty years unless they are particularly required for seed-bearers or couvert, should be marked for felling. Mr. Legat has had some experience of the marking of Sections at Knysna, and I could write him further regarding details. I am

of opinion that a Section here should be opened as soon as a forest station is established, and the Section should be ready not later than next April.

The general plan of working the indigenous forest should be that known in the text books as "jardinage regularisé," or selection felling in Sections. The Section should be so arranged that a series of Sections is completed during the rotation, which I recommend should be fixed at 20 years. The period for the Cape forests was fixed at 40 years. This has the disadvantage of leaving mature wood as an unrealised capital too long on the ground and of felling too much at one time. Perhaps on this account it has not produced the natural regeneration that was hoped for. It has the advantage of concentrating the work more than in the case where the Section is larger and the rotation shorter, and it puts the forest in the way of conversion to a regular forest. Some years ago I discussed this question with Sir D. Brandis, and he agreed with me that, although 20 years might have been a better rotation, it would be inadvisable now to make a change at the Cape. In France the rotation is rarely longer than 10 years. It is 10–30 years in the Teak forests of Burmah, and 40 years in some of the Indian Sal forests.

Boppe and Jolyet, in their recent Sylviculture, state: "In general, more frequent cuttings are advisable with shade-bearing than with light-demanding species, in fertile than in poor soils, in favourable than in severe climates." Here the species are all shade-bearing, the soil is fertile, and the climate favourable, so that, according to European practice, the cuttings should be repeated more frequently than at intervals of 20 years. Here, however, the necessity of concentrating the fellings for police work and for supervision renders 20 years, in my opinion, sufficiently short.

D'Arcy, in his "Forest Working Plans," thus describes the "Group" method, which would be the alternative to "Jardinage," in the treatment of the indigenous forest:—

"*The Group Method.*—This is merely a modification "of the method of successive fellings. All the calculations "connected with the manner of prescribing the possibility, "etc., are identical in the two methods, and the gradual "exposure of the young seedlings is secured by means of "two or three successive regeneration fellings. These "successive fellings are, however, in the group method all "made simultaneously by groups; that is to say, wherever "a patch of seedlings is already established, it is at once "exposed, in greater or less degree, to the climatic in-"fluences. Where seedlings do not exist, the cover is "opened out with a view to their establishment. The

"method, in fact, amounts to this, that the volume of "material to be felled annually in the block under regenera-"tion having been determined, this volume is felled by "patches or groups wherever a group of established seedlings "extends. The method is applied in exactly the same way "as the method of successive fellings, and comprises similar "clearings, thinnings, and selection fellings."

The value of this indigenous forest will be realised when it is mentioned that for the last 15 years an average of nearly 100,000 sleepers has been supplied from the Knysna forest yearly to the Cape Government Railways, and that from this and Yellow-wood for house-building and wagon wood, the average yearly revenue in timber licenses for the Knysna Conservancy has amounted to from £3,000 to £7,000 yearly. The total area of the indigenous forest at the Cape is computed at 500,000 acres, of which the value has been capitalised at £2,000,000.

FOREST DEMARCATIONS.

I have indicated, under Plantations, various tracts of ground which should be reserved for timber plantations. To settle the boundaries of the existing forests, demarcations are necessary. For this work Government Surveyors on account of their cost, should only be employed when it is absolutely necessary, in the case of a disputed boundary. Ordinarily, forest demarcation should be done by a Forest Officer specially appointed and equipped for the purpose. The forest boundary should be fixed by temporary beacons of rough stone or otherwise, and these boundaries shown on a plane-table sketch. It is the duty of the Demarcating Officer to visit each detached portion of a forest, to examine its contents, and estimate its worth to the country as a forest reserve. Sometimes several small pieces of forest can be included within one perimeter, and with the help of plantations form the nucleus of a valuable forest. On the other hand, a small isolated patch of forest may be better left to the general protection accorded to the second class of forest known as "undemarcated forest." When visiting the indigenous forest in the neighbourhood of Wood-Bush and Haenertsburg, I was strongly impressed with the necessity of immediate arrangements for forest demarcations.

Going from the Wood Bush Range to Haenertsburg, the forest breaks up into small scattered patches, which, in order to be brought together for practical forest work, require study and care on the part of the Demarcating Officer. And this, too, is the class of forest which is most exposed to depredation from the native cultivator. At

Haenertsburg I found the same sad story of forest destruction repeated, with which I was rendered so familiar 20 years ago in the Amatolas. My first duty on arriving in South Africa from India was to demarcate the Amatola forests, and here I pitched my tent, erected beacons, and gave the forest boundaries, which were afterwards confirmed by the Forest Commission of 1886. This Commission consisted of the Assistant Surveyor-General for Cape Colony, the Native Magistrate, and myself. Afterwards, in 1888, the Forest Act was passed, constituting these demarcated forests portions of the future National forests of the country. At and near Haenertsburg to-day there is an exact repetition of what took place in the Amatolas 20 years ago. On every side one sees patches of forest with burnt squares of mealie gardens eating into them.

Each year the destruction of the forest is advanced a step further, the natives with their mealie gardens ever encroaching on the rich forest soil, and after a few years abandoning it for fresher and richer forest soil. Many of these mealie gardens near Haenertsburg show the remains of large trees burnt within the last year or two, and in one instance the ground had been burnt over only a few days previously. All such burnt areas should naturally be brought again within the forest boundaries. Probably all that would be required to restore them to forest would be the sowing of Black-wattle and Pine in alternate strips, the Black-wattle serving to protect the Pine from forest fires.

PROCEDURE.

The Demarcating Officer, having built temporary beacons and prepared a plane-table sketch illustrating the position of the beacons, would submit his plan, together with a carefully worded description, to the Conservator, who submits it, confirmed or amended, to the Director of Agriculture for transmission to the Survey Department. The plane-table plan or sketch might be accompanied by photos, particularly when the forest is in patches on the mountain side, like the "shola" forests of the Nilgiris in India. After due notice and the consideration of any objections that may be received, the forest demarcation becomes final by proclamation in the *Government Gazette*. The procedure followed at the Cape will be found indicated in the Cape Forest Act (No. 28 of 1888), submitted with this report.

For the North-East of the Transvaal I recommend the appointment of two Demarcating Officers at once. Probably, active men, well able to do this work, can be

secured at a salary of £300 and their expenses. They should be provided with donkey or mule transport, and in the worst districts, pack-saddles and tents. It might be possible to pay them by tariff, as is the case with Cape Government Surveyors, at so much per beacon erected, per length of boundary, and per area demarcated.

SOME LOCALITIES WHERE DEMARCATION IS URGENTLY REQUIRED.

Wood-Bush Range.

The demarcation of the Main forest near Wood-Bush (comprising Groot-Bosch and Hells-Bosch) seems to be easy; the forest is a fine natural block of forest, and the farms around it have been surveyed. It remains, therefore, only to construct a skeleton plan of the ground left between the farms, and to fill in the details of the forest and of the topography with a plane-table survey. The Transvaal Government have an asset there of which it would be difficult to over-estimate the value.

Modjadjes,

about 60 miles north-east of Haenertsburg. Here I understand that the forest destruction which I witnessed at Haenertsburg is proceeding so rapidly that, unless early measures be taken, the whole of the indigenous forest will be swept from the hill-side, as has been the case near the native locations in Natal. I recommend that a Demarcating Officer be appointed to proceed with the demarcation here *at the earliest possible date.*

It will be necessary, probably, that his lines, in the first instance, should be tentative and subject to the approval of the Officer in Charge of Native Affairs. The important point is to obtain boundary lines for the forest, and thus render it possible to stem the advancing tide of forest destruction.

DEMARCATION NEAR HAENERTSBURG.

The elevation of Haenertsburg is stated at 4,500 feet; it is close to the rise from the low country on to the Transvaal plateau. There is evidence of a good rainfall all over this mountainous country, and though there is no large block of forest like the main forest at Wood-Bush, there is much scattered forest and great scope for careful demarcation. When at Haenertsburg I ascended to the top of the Volkberg, and the view from there, together with the enquiries I made, convince me that there is much

useful forest demarcation to be done near Haenertsburg. I am of opinion that one or two Demarcating Officers should be appointed there.

THE FOREST STAFF.

For the Chief Forest Officer in the Transvaal, with the title of Conservator, I recommend that the pay should not be less than £1,200 per annum. I make this recommendation not with reference to the large salaries now paid in the Transvaal, but in view of the actual payment necessary to secure a well-qualified man from India or elsewhere. To a senior man more would naturally have to be paid. It must be remembered that a qualified Conservator is not only an expert whose education has cost him more than most of the other Government experts with salaries averaging close on £1,000 per annum, but he is the administrative head of the Forest Department controlling an expenditure, which for the Transvaal should not be less for many years than £100,000 per year.

THE FUTURE FOREST STAFF.

As regards future appointments, I should recommend that to a Forester in charge of a nursery or forest the commencing salary should not be more than £150 or £200 and house. The class of men to be appointed should be married men of the working class. They should be given a comfortable four-roomed cottage, and from 6 to 10 acres of ground for garden purposes and for a cow and poultry. While not allowed to farm for profit, they should be encouraged to assist their pay with the produce of their garden and land. Married men should invariably be given the preference as Foresters. Indeed, it is a good rule to appoint no unmarried men as Foresters, capable young unmarried men being appointed as Assistant Foresters. It is not necessary to give a horse allowance to a Forester in charge of a plantation or compact forest area. The horse allowance, when necessary, should be in the form of a forage allowance towards the keeping of a horse, and should not exceed £20 or £30 per year.

The District Forest Officer.—There is a tendency in the early days of forest organisation in most countries to appoint too many inspecting forest officers at high salaries, and no qualifications for the work beyond a liking for an unsettled life! I am of opinion that to men who have served a period of probation and been found efficient the pay of District Forest Officers in the Transvaal should begin at not less than £300, and should carry, in addition, a house or house allowance.

Seedsman.—The collection and distribution of forest seeds is an important part of my work at Capetown. For this purpose, nearly the whole time of one man as seedsman is required. He works in my office when not actually handling seed at the seed store. The seed is stored in a warehouse I built for the purpose at Woodstock ten years ago.

I recommend that a similar Government Seed-Store should be established in Pretoria, and the services of a seedsman engaged. The seed business at Capetown is run so as to leave only a bare margin of profit. The gain to the tree-planter in the price of seed is enormous. It might be a workable and an economical arrangement to combine seed-store work with the nursery work at Irene. It is naturally a convenience to the public to be able to obtain trees and seeds at the same place. There is no greater help to the reforesting of a country than the supply of *reliable* tree seeds at moderate cost.

During my recent tour in Natal and the Transvaal I noticed quantities of tree seeds going to waste. There are tree seeds in Natal and the Transvaal which are not obtainable at the Cape, and *vice versa*. It is quite one man's work to attend to the collection and distribution of tree seed to the public.

Spring is the time for gathering most Eucalypt and Pine seeds, so that a seedsman should be appointed without delay for the Transvaal work.

It may be noted that the Customs Return for 1902 shows nearly £20,000 spent on seeds imported to the Transvaal—plants and trees.

NATIVE POLICE.

It is desirable to spend as little as possible on the purely police-work of the forest, this being done automatically by the resident staff, who are largely employed in other duties; but for the present, and perhaps for many years, it may be desirable to employ a certain number of Native Police. The Zulu Police in Natal do excellent work, and the Native can generally catch the Native in the forest more easily than the European. I recommend that three Native Policemen be now placed under Mr. Eastwood's orders, one for employment at Mojadjes, one in the main forest, and one for the scattered forest about Haenertsburg.

NECESSITY OF ECONOMY IN FOREST STAFF.

Though some of the salaries recommended above may appear low compared to the present Transvaal scale, it

must be remembered that, while these, owing to recent events, are exceptionally high, forest salaries are generally necessarily low. For much forest expenditure there can be no return for one or two generations, so that economy in every branch of working is the first essential of success. The career of a Forest Officer is healthful and honourable, but not lucrative, and in most European countries (as also at the Cape), the men occupying the superior grades have some private means. For the rank and file, everything should be done to make the men comfortable and contented with their low salaries. Economy in salaries is the *sine qua non* of forest administration. The Forest Department is not the place for the man who wishes to make money and retire on a competency!

In Germany and France the Foresters form a Corps of Guides liable to military service. and on account of their great usefulness in this respect they should be in receipt of a small retaining fee from the Military. Government officials, travellers, and sportsmen, when allowed to stay at the forest stations, naturally pay them something, too ; and they are often allowed bonuses for successful forest cases in the Law Courts and for impounding cattle, as well as fees for official Government work, such as the collection of agricultural statistics. So that it becomes possible to secure first-rate men at salaries below what would be paid to Government officials in other Departments.

In Germany, France, and Austria the pay of the Forest Officials is surprisingly low, yet they are all well educated and highly trained, and they often spend years on probation, with little or no pay, waiting till there is a vacancy. The Forest Staff in these countries is one of the most efficient and economical branches of the public Service.

FOREST STATIONS AND BUILDINGS.

Main Forest.

The first forest station calling for attention is that in the Main forest (Groot Bosch), Wood-Bush Range. The site for this important station was fixed at our recent visit to this locality. Little effective work can be done at this most useful centre until a Forest Officer is housed near the work. It is imperative, therefore, that this house should be put in hand with the least possible delay. It should include a house of five or six rooms for the Forest Officer, together with two inspection rooms on account of the remoteness of the locality.

The house should be built under the supervision of the Forest Officer, and it will probably be found most economical to employ for the timber sawn Yellow-wood timber from the adjoining forest.

When these cottages were built at Knysna, the Yellow-wood was obtained, free of cost, by cutting a quantity of damaged and waste trees in the neighbourhood, the cutting being done on the half or one-third share. As the work develops in this locality, possibly two or more Foresters' cottages of about half the size and cost of this will be required; but, for the present, this cottage will probably suffice here.

HAENERTSBURG.

Here I recommend the building of a five or six-roomed Forester's cottage. The two patches of indigenous forest near Haenertsburg and the adjoining ground should be the first to be demarcated as a forest reserve. And the locality being situated on the main road from Pietersburg to the Low Country, the site is one well adapted for a forest nursery and forest plantations. The area of the two patches of indigenous forest at Haenertsburg is estimated at 50 acres for the nearer forest and 60 acres tor the further one. The soil is rich and deep, the rainfall good, and the forest has produced timber of large dimensions. It is full of the remains of old trees and of saw-pits, showing where they have been worked.

RAILWAY PLANTATIONS.

I had the advantage of discussing the establishment of railway sleeper plantations with His Excellency the Lieutenant-Governor and the Manager, Central South African Railways. Cape Colony has adopted a scheme whereby £50,000, spread over five years, is to be spent on a series of railway sleeper plantations, which are calculated to produce about one million cubic feet annually, and to commence to produce mature timber in twenty or twenty-five years. One million cubic feet per annum is estimated to be the Cape requirements in sleepers on a mileage of 2,300 miles. Since this scheme was sanctioned, further railways have been opened and are in progress, and a further extension of the railway sleeper plantations is in contemplation. Cape Colony has now to send nearly £100,000 yearly out of the country to pay for imported sleepers. Sir Arthur Lawley and Mr. Price agreed that a similar plan should be adopted for the Transvaal. I trust that there will be no delay in putting it into execution. According to the evidence given by Mr. Price before the

Native Labour Commission on the 27th August last, the following length of railway lines are now open :—

Cape	.. .. ..	2,784 miles.
Transvaal	.. .. ..	1,335 miles.
Natal	.. .. ..	635 miles.

Thus at present the railway mileage of the Transvaal is about half that of the Cape, and the sleeper requirements will vary accordingly. But I understand that the new railways projected in the Transvaal amount to a doubling of the existing mileage at no distant date, and the Cape mileage has increased since the scheme was adopted ; so that, for practical purposes, the Cape scheme for sleeper plantations should be adopted in its entirety.

The sites for the railway sleeper plantations in the Transvaal should lie on the lines of railway, and be not far from the eastern edge of the plateau country, so as to enjoy the benefit of the greatest rainfall.

The farm Gemsbokfontein, referred to above, will form one good site for a sleeper plantation, and provide probably 4,000 acres of good timber ground. On a 150 "Acrim," 4,000 acres would yield 600,000 cubic feet of timber yearly, or enough sleepers for the present mileage of the Central South African Railways, while a second farm similar to Gemsbokfontein would provide for that doubling of the present mileage which I understand is contemplated in the near future. It would be preferable to buy a second farm selected for accessibility and rainfall. The Cape Government recently purchased a farm of 4,000 acres at Ceres Road for one of their sleeper plantations.

The Cape Railway Sleeper Plantations.

The following figures from my recent Johannesburg lecture on Forestry may be reproduced here for easy reference :—

"With a mileage of 2,000 miles open, and 2,000 sleepers per mile at 5s. each, and an average life of 10 years for the sleepers, the Cape Government Railways have to spend about £100,000 yearly on sleepers. Considering these facts, and seeing that the identical sleeper woods now being imported can be grown under the same climatic conditions in Cape Colony, the late Commissioner of Railways, Dr. Smartt, determined to form a series of plantations calculated to supply all the wood now being imported for sleepers. For this purpose £10,000 has been provided on the current year's forest Estimates, to be followed by a similar sum for the next four years, or £50,000 in all.

The Profits of the Enterprise.

"If we allow interest at 3 per cent. (the Government borrowing rate), and consider that thinnings will balance the cost of maintenance, this £50,000 will have become £100,000 in about 25 years, and then what will happen? The £100,000 capital becomes £100,000 yearly revenue. Or, in other words, £100,000 has been spent in the formation of an estate which will produce a yearly yield of timber worth, at present market rates, £100,000 per annum. Thus the financial position of these sleeper plantations is particularly strong.

Sleeper Timber Wanted.

"It is estimated that on a basis of 2,100 miles of railway open (in 1901), 2,000 sleepers per mile, $2\frac{1}{2}$ cubic feet per sleeper, and 10 years' sleeper life, the Cape Government Railways want now yearly :—

$$\frac{2{,}100 \times 2{,}000 \times 2\frac{1}{2}}{10} \text{ equals } 1{,}050{,}000 \text{ cubic feet.}$$

say one million cubic feet yearly.

Timber, How Produced.

"To produce this one million cubic feet, plantations are being laid down thus :—

	Cubic feet.
3,500 acres Eucalypts with a 200 estimated 'Acrim'	700,000
3,000 acres Pines with a 100 estimated 'Acrim'	300,000
Total, cubic feet	1,000,000

"In taking the 'Acrim' (or average yearly acre-increment) of timber at 200 for Eucalypts and 100 for Pines, very safe figures have been taken. From sample plots at Tokai, near Capetown, an average yearly growth has been obtained as high as 600 cubic feet, and from the Blue-gum plantations in India and at Knysna as much as 700 cubic feet per acre per year has been realised. I have no doubt, from plantations that I have seen in the Transvaal, that many of its timber plantations are in places yielding up to this figure of 700 cubic feet.

"As regards Pine, as much as 300 cubic feet per acre per year has been obtained in the best plantations near Capetown."

FOREST LAW.

It would be advantageous for forest work in the Transvaal to have a Forest Law similar to that of Act 28 of 1888 and Act No. 18 of 1902 in Cape Colony. Copies of these are appended. I do not think that the framing of a Transvaal Forest Law should await the arrival of a professional forest officer from abroad. He may not be appointed for several months more, and his want of local knowledge for the first year or two renders it all the more advisable that he should find things ready to work with than be asked to frame an Act for a new country. The Cape Forest Act has been successfully enforced since 1888. The amending Act of last year was almost entirely in the direction of increased stringency. The existing Forest Law in the Transvaal is defective in some respects and unworkable in others. If I am not mistaken, it is modelled on some rough suggestion which I helped Count de Vasselot to frame many years ago.

When I was discussing forest demarcations at Haenertsburg, the question of gold rights was raised. There is no essential antagonism between forest conservation and gold mining. The gold miner destroys a little forest at the surface, but he opens the market for the inferior class of forest timber, which is a valuable resource to a forest properly worked.

When a portion of the Knysna forest near Millwood was proclaimed a gold field, little or no damage was done to the forest. The gold miner was not allowed to destroy forest unnecessarily, and he paid a fair rate for the forest produce which he required. But if the forest be left in an abandoned condition, the gold miner comes to look upon it as nobody's property; he too often destroys it recklessly, and then blames the Government for allowing it to be destroyed.

METEOROLOGICAL OBSERVATIONS AT FOREST STATIONS.

Rain gauges should be kept at all the forest stations. It is evident that the rainfall is the chief factor in regulating the amount that can profitably be spent on timber plantations in each locality. A series of rainfall observations maintained without break for 15 years would be valuable and well worth the trouble entailed. As a rule, the observations should be limited to this, since the forest official has sometimes to be away from home, and the rain-gauge can be measured by a deputy; while more extended meteorological observations cannot be so easily arranged for, and almost the whole value of the work lies

in its continuity and accuracy. Of the forest stations proposed in this report, undoubtedly the most useful, meteorologically, is that in the Main forest of the Wood-Bush Range ; the figures from there would be of importance as indicating accurately the condition of the south-east Trade wind in that part of South Africa ; and I should be glad to obtain figures from there for embodying in the account of South African weather, which I have been in the habit of sending yearly to India for the preparation of the "Monsoon Forecast." On account of the importance of this station, it would be advisable to add an anemometer to the usual rain-gauge equipment.

When in Johannesburg I discussed details with Mr. Innes, the head of the Transvaal Meteorological Department, and understand that he will be in a position to supply rain-gauges, and an anemometer for the "Main Forest" station, as soon as the stations are established and the Staff ready to begin observing.

FOREST ORGANISATION.

Though the Meteorological, Agricultural, and other Departments of the United States of America are models that may be safely copied, it is not so with Forestry.

The forest organisation of the United States of America has made great strides during the last five years, but it is admittedly incomplete, and far from the perfection attained by the older forest organisations on the Continent of Europe, where forestry has been systematically practised for over 400 years. (Ordonnance du Comte de Mansfield, 1585.) To some extent this imperfection in the United States may be due to political reasons and a too close association with agriculture. The farming interest there represents the chief interest in the Legislation, and there has been a reluctance in the United States for many years to advance beyond arboriculture and advisatory forestry. Forestry, however, is the business of the State, in a practical sense—a national work, which only the State with its long life can satisfactorily carry out. Agriculture is the business of the farmer, and it is not the duty of the State to meddle with agriculture or fruit-growing beyond assisting private enterprise with the advice of experts. It is an axiom in the Forest Schools of Europe that the length of time required to produce timber of large dimensions places it outside the ordinary laws of supply and demand. It is the duty of the State, through its Forest Officers, to supply its citizens with timber. It is not the duty of the State to supply its citizens with fruit trees, cabbages, or agricultural produce, and to attempt to do so is to discourage private enterprise.

In spite of the very great stride that is now being made by Forestry in the United States, the organisation of the Government Forest Department is still very defective. Three of the Departments of the Federal Government have their Bureaus or Divisions of Forestry. There is a Bureau of Forestry in the Department of Agriculture, and a Division of Forestry in the Department of the Interior. Some of the best forest reports have been brought out by the Geological Department. Then there are numerous State Forest organisations, and several of the Universities are owners and practical workers of forests, with their own forest stations and arboreta. Says Mr C. H. Shinn, a Federal Forest Officer :—" We may come at last to have a ' Secretary of Forestry and Water Supplies ' sitting in the President's Cabinet."

GENERAL TREE-PLANTING—PRIVATE AND MUNICIPAL.

The adoption of an efficient system of National Forestry will be the most powerful stimulus to that general tree-planting which is so much required on the usually treeless plateau of the Transvaal. In Cape Colony private and Municipal tree-planting is encouraged by :—

(1) The sale of young trees and seed at cost price.
(2) Grants on the pound per pound principle to Municipalities.
(3) Prizes for tree-planting to farmers and landowners.

In some countries, notably in South Australia, trees are issued free, but this has the disadvantage of encouraging careless tree-planting and discouraging private enterprise in the production of trees.

At present the supply of young trees from private nurseries in the Transvaal is in no way equal to the requirements of the country. Trees, too often climatically unsuited to the Transvaal climate, are sold at rates so high that there is a constant demand for surplus trees from Cape nurseries, in spite of the long and very risky journey of over 1,000 miles by railway.

Price of Young Trees.

As in Cape Colony, young trees will be distributed at cost price from the Government Nurseries scattered over the country and from the large central nursery to be established at Irene. I understand that 50,000 young trees have already been sold from the Government Nursery at Skinner's Court, near Pretoria. From the large nurseries

near Capetown all the common timber trees, ornamental trees, and hedgerow trees are sold at a uniform rate of 4s. per 100, and if these nurseries were situated (as will be the Irene and other nurseries in the Transvaal) on the line of railway, it would be possible to sell remuneratively at lower rates.

It not unfrequently happens that surplus trees are purchased from Cape nurseries and then re-sold at ruinous rates to the public in the Transvaal. When in Johannesburg I learnt that the ordinary retail price for hedgerow trees was £2 per 100. This may be compared with 4s. per 100, the Cape rate for transplants in tins, with 4s. per 1,000, the Cape rate for seedlings, or 4s. per 1,000, the rate at which open-root forest trees are commonly sold from nurseries in Europe.

Seeds.

The desirability of supplying tree-planters with reliable seed at moderate prices need not be emphasized here. The arrangements connected therewith have been mentioned under "Staff."

Aid to Municipalities.

This is regulated in Cape Colony by Act 4 of 1876, a copy of which is appended to this report. See also Government Notice No. 511 of 1900, framed under Act No. 28 of 1888, also appended. It is gratifying to notice an item of £1,000 for this purpose on the Transvaal Estimates.

Prizes for Tree-Planting.

Prizes for successful tree-planting have been awarded from time to time, and rewards have been paid for the successful planting of sand-drifts on the Cape Flats. I think it desirable that as soon as the Government Nurseries are in full working order, and the growth of climatically suitable species demonstrated, that a tree-planting competition and a system of awards for successful work in tree-planting should be announced.

FUNDS FOR FOREST WORK.

Imported Timber.

During 1897-98 the Transvaal imported of timber :—

	Manufactured.	Unmanufactured.
1897 ..	.. £258,741 ..	.. £178,145
1898 ..	.. £217,447 ..	.. £130,013

During 1902 the value of timber imported amounted to £342,660, of which £275,332 is classed as "Unmanufactured" in the Customs Return (Government Notice No. 50 of 1903). This is exclusive of furniture and cabinet-ware, which was imported to the value of £373,175. Altogether, timber in its various forms is the bulkiest and most costly article imported into the Transvaal after mining machinery. It reached a total of £715,835 for 1902, exclusive of timber and wood imported free for Government use, civil and military. This may represent another £200 000 worth, bringing up the grand total of the Transvaal's timber bill for 1902 to something not far short of *a million sterling*. Manufactures tend to follow an abundance of the raw material. Lancashire was first in the field with its manufactured cotton goods; but, in spite of this advantage and cheap coal, it is being closely pressed by the countries that produce the raw material, Japan, India, and America.

Whatever way we look at it, the Transvaal's lost million for timber is a serious matter, and the organisation which claims to restore the forests of the country is not one to be lightly passed by with a quite inadequate appropriation.

There is no question but that the timber now imported can easily, economically, and safely be produced within the Transvaal; economically, if the Forest Department be prudently organised and managed; safely, if trees climatically well suited to the Transvaal are employed. That the Transvaal was once a well-timbered country we see in the coal-beds and fossil remains of much later date; that all its eastern border is well adapted to produce timber to-day is an ascertained meteorological fact; that trees, even in spite of much bad selection, generally grow well in the Transvaal, every tree-planter is ready to testify. We see even rank exotics, such as *Pinus insignis* and *Cupressus macrocarpa*, growing well for many years. Many of the Australian trees (altitude compensating for latitude, as with the indigenous forest) grow with the utmost vigour; while in Mexico and the Western Himalayas we have fine forest floras flourishing in climates that closely reproduce that of the Eastern Transvaal.

It must be remembered that, while Agriculture is heavily handicapped by the absence of winter and spring rains and the occasional failure of the summer rains, some of the finest timber trees in the world flourish naturally under a rainfall so distributed. And happily it is easier to import wheat than timber. Last year while the Transvaal spent £275,332 on unmanufactured timber, only £245,739 was paid for all the wheat and wheaten flour.

Indeed, the dearness of timber is perhaps the chief factor in the present high cost of living in the Transvaal. It makes house-building costly, and house-rents high; the artizan cannot accept the low wage in the Transvaal that is possible elsewhere, and manufactures are kept out of the country. This reacts again on the cost of living and makes it higher still, since all manufactured goods have also to be imported. Thus, for instance, last year as much as £211,000 was spent on imported bicycles. The two items of import ranking above timber are machinery and clothing. In great part, at any rate, these must continue to be imported, but to continue to import timber when timber of every class is so easily produceable within the Transvaal is sheer waste of the country's resources. Cheap timber is the prime necessity for cheap living in a civilised country, and a lowering of the price of timber should, I submit, be a cardinal point in the policy of every enlightened Government in the Transvaal. It is the duty of the Government to encourage and advise the farmers on Agricultural matters. In Forestry it has to do more. It is the duty of the State to itself produce the timber required. The bulk of the timber required by the nation must be produced in the State forests of the country. This is the verdict of those who have studied the social economy of the matter in the universities of Europe. It is a verdict that may be slighted, but cannot be gainsaid. If slighted, the penalty has to be paid. England, to-day, pays £26,000,000 yearly to the foreigner for imported timber, and consoles itself with comfortable free trade maxims. This timber, it has been calculated, could be grown two or three times over on the waste lands of the British Isles. The older nations of Southern Europe have destroyed their forests, and suffer from chronic poverty and a deteriorated climate. The United States of America have destroyed three-fourths of their splendid forest resources, utilised one-fourth, and are now getting alarmed at the forest exhaustion with which they are threatened. In the United States of America the average consumption of timber per inhabitant is 85 cubic feet, and besides this 265 cubic feet of wood fuel; altogether, there is an average consumption of nearly 1 cubic foot per head per day. Germany uses 43 cubic feet per head per year, while England, with her ruined forests, has to make shift with only 13 cubic feet per head per year. President Roosevelt, in a recent speech, dwelt strongly on the necessity of forest resources in the making of happy homes. He described, also, the close relation between mining and forestry. Mines cannot be economically worked without abundant wood and water. There are rich mineral resources in

some of the Western States that cannot be economically worked owing to the want of cheap timber. Those who would care to pursue the subject further may read the following :—

(1) "The Outlook of the World's Timber Supply," by Dr. W. Schlich, Ph.D., Principal Professor of Forestry at the Cooper's Hill Forest School. Journal of the Society of Arts, London, and "Cape Agricultural Journal," September 12th, 1902.

(2) "National Forestry" (British), by D. E. Hutchins. "Journal of the Society of Arts." November, 1899, and "Cape Agricultural Journal," January 17th, 1901.
(This paper was awarded the Society's Medal.)

(3) "Insuffisance de la Production des Bois d'œuvre dans le monde," by A. Melard. Imprimerie Nationale, Paris, 1900.

(4) "National Forests" (Cape), by D. E. Hutchins. Philosophical Society. Capetown, August 3rd, 1898.

(5) "Economics of Forestry," by Dr. Fernow, 1902. Cornell, New York.

Reprints of (1), (2), and (4) are attached to this report.

Recognising it as the policy of the Transvaal to produce its timber at home, what should it spend yearly? The Cape now spends £60,000 yearly in forestry. Natal, making a commencement with forestry, has an expenditure, this year of £10,000. Considering the relative importance of the States, it is evident that the Transvaal should spend not less than £100,000 yearly on its Forestry.

In a recent lecture before the South African Association for the Advancement of Science ("Transvaal Agricultural Journal" April. 1903), I estimated that the Transvaal would require not less than 50,000 acres of timber plantations. 50 000 acres at a mean yearly yield of 150 cubic feet would supply 7,500,000 cubic feet yearly, which is almost exactly the amount of timber imported into the Cape Colony during 1902. If we average the cost of these 50,000 acres at £12 per acre, their total cost will amount to £600,000. If £100,000 be spent yearly, they will be completed in six years. Obviously six years is quite long enough to delay before doing all that is necessary to stop, at the earliest possible date, the drain on the country's resources involved in the present importation of timber from abroad and the drag on the country's development owing to the scarcity of wood, that prime necessity of civilised life.

I trust, therefore, that funds will be provided to carry out forthwith the measure sketched in this report, and that next year and the following years the Budget provisions for Forestry will embrace £100,000 yearly for plantations, together with a further small amount for the working of the indigenous forests (exclusive of plantations) and the pay of the controlling forest staff.

THE TRANSVAAL NATURALLY FITTED TO PRODUCE TIMBER.

What geological change has brought about the present nearly treeless condition of the Transvaal we do not know. It may have been a climatic change, a period of excessive drought following a period of excessive rainfall. It may have been the action of man and his grass fires. The distribution of forests has puzzled the best observers. Darwin, in his voyage of the "Beagle," discusses the anomalous condition of the Falkland Islands. There is heavy forest on the mainland of the southern extremity of South America. Winds and ocean currents distribute the seeds of these trees along the shores of the Falkland Islands. The Falkland Islands have a damp climate, well adapted to tree-growing. Yet there is not an indigenous tree on them. Darwin was quite unable to account for the absence of trees on the Falkland Islands, though possibly a Forester would account for it by the remarkable growth of the grass there, or the want of shelter.

It is certain that the eastern side of the Transvaal is now climatically fitted to carry forest of high economic value. It closely resembles Mexico, and Mexico is peculiarly rich in its Pines and Cedars, trees which produce the exact class of timber now imported at such heavy cost from the Northern Hemisphere to the Transvaal. It is nearly certain, further, that, if the Transvaal with its present climate had been situated in the Northern Hemisphere, Cedars and Pines, now entirely absent from its forests, would have abounded.

CEDAR AND PINE TIMBERS.

Cedars.

It is the Junipers that yield the typical Cedar wood. There are about 30 species of Juniperus, but only about two-thirds of these are large enough to be of economic value. Of other trees yielding Cedar, there are 15 species of Cypress, 5 of Libocedrus, 2 Sequoias (one the finest timber tree of all the Cedars and one second rate), 2 Taxodiums (both first-rate Cedars), 1 Glyptostrobus, 1 Skiadopitys, and 2 Cedrus.

There are about 13 species of Callitris (including Actinostrobus Widdringtonia and Tetraclinis), *i.e.*, 9 Australian, 2 Cape, 1 Central African, and 1 North African. It is the genus that after Juniperus and Taxodium produces the best Cedar-woods. The Callitrises are somewhat faster-growing than the Junipers, but slower than the Cypresses. Cape Cedar, the most valuable indigenous timber of South Africa, is *Callitris arborea*. *C. Whytii* is the M'lanji Cedar of the temperate highlands of Central Africa. The Australian *Callitris calcarata* has the texture of Cedar with the colour of Stinkwood, and is the handsomest timber in the Kew Museum.

Pines.

There are 70 species of Pines, which is about half the total number of Eucalypts. Of these 70 species, barely one-half yield valuable timber. Forty-one species of Pine have been selected as suited to test cultivation in the Transvaal. There are about 12 or 14 species of Pine on the mountains and higher plateau-country of Mexico.

Pine-like Timbers.

Of the conifers yielding Pine-like timber there are Belis 1 species, Ginko 1 species, Agathis 10 or 12, Araucarias 10 or 12, Dacrydiums 2, Fitzroya 1, and Phyllocladus 3. There are upwards of 50 species of Podocarpus (including Prumnopitys), most of them tropical trees with second-rate Pine-like timbers, though the extra-tropical species of South Africa, South America, New Zealand, Australia, and Japan are trees of considerable economic importance.

Larches.

The Larches generally yield a superior quality of deals. There are about 9 species of Larix and 1 Pseudolarix (Laricopsis), or altogether 10 Larches. The European Larch would be useless in the Transvaal, and only the Himalayan and Japanese Larches have been entered on the list for trial planting in the Transvaal.

Firs.

The Spruces and Silver-firs, generally yield wood of inferior quality as timber, but of increasing value as paper-pulp. There are about 16 species of Picea (Spruce), 23 species of Abies (Silver-fir), 7 species of Tsuga, and 3 species of Pseudotsuga (Abietia), the Pseudotsugas having better timber. Thus altogether there are about 49 or 50 species of Fir. These trees as a class fear dry hot winds, and are little suited to South Africa.

YEWS.

The Yews, on account of their slow growth, have no value as practical timber producers. Some botanists look on all the Yews as only geographical varieties of the common Yew of England.

Grouping these timber-producing Conifers, we have :—

60 species of Cedar or Cedar-like timbers.
35 species of Pine timbers.
80 species of Pine-like timbers, such as Podocarpus.
10 species of Larch.
50 species of Firs.

Total—235 species of Coniferous timber.

Of these 235 species of Coniferous timbers, I have brought 119 species on to the Transvaal list, as being more or less suited for cultivation in the Transvaal, and worthy, at any rate, of test planting. To this may be added 11 species of Cedrela, which also yield Cedar-like timber.

It may be noted that the list comprises also the following :—

43 species of Eucalypt.
28 species of Oak.
7 species of Mulberry.
11 species of Willow.
5 species of Ash.

The total number of trees on the Transvaal list is 454. It naturally cannot claim to be complete. A complete list of trees suitable for growing in the Transvaal would be of great length, and would probably be of less use than the shorter one here compiled, which is believed to embrace all the most useful and interesting trees suited to the temperate plateau climate and the mountains of the Transvaal. In the unhealthy Low Country of the Transvaal extensive tree-planting operations are not under contemplation, nor is this country well suited to produce the Coniferous timber which is mostly required in the Transvaal. In the following list I have marked to be printed in italics those trees that have already been successfully grown in the Transvaal; a single tree in a collection, unless it shows very strong evidence of successful naturalization, is not italicized. Further, all the trees in the list have been sorted into first grade and second grade, and an asterisk has been added to those of first-rate forestal value. For the sake of brevity and simplicity,

the botanical authors of the names of trees and synonyms have only been added when this was necessary to avoid confusion.

The three most important classes of timber on this list are the Pines, Eucalypts, and Cedars. I have mentioned every Cedar known to me as likely to succeed in the Transvaal. The Pines in the list might be criticised as being relatively too numerous as compared with the Eucalypts, but this is intentional. It is Pine timber which is now mostly imported, and which is of the first importance, for house-building and for reducing the cost of living in the Transvaal. And further, the Transvaal plateau and mountains are better suited to the production of Pine timber than of Eucalypts. Mexico is famous for its Pines and Cedars. Pines grow on poorer soils than Eucalypts, they stand frost better, and they make less demand on sub-soil moisture. In one particular only are the Eucalypts better, that is to say, in their resistance to fire. Apart from systematic forestry, it will probably be always difficult for young Pine plantations in the Transvaal to pass through the dangerous period (about 10 years) while they are in the pole stage.

TREES FOR THE TRANSVAAL.

(1) (2)—Trees of first and second rate value in the Transvaal.

* Trees of special value.

SLOPING TYPE—Trees already growing in the Transvaal.

(2) ABIES DELAVAYI.
Yunan. ("Index Floræ sinensis."—Dr. Masters.)

(2) ABIES FIRMA (A. *momi* of Sargent)
The Momi Silver Fir.

This, according to Sargent, is "the largest of the Japanese Fir trees, and an inhabitant of the mountains of southern Hondo, where it is said to be abundant in the forests of deciduous leaved trees; it is the species best known to the Japanese, furnishing them with the fir wood of commerce, and one of the chief ornaments of their parks." It is a poor tree in Europe and North America, but one of the most beautiful in Japan. This and other Japanese trees are only suitable for cultivation on wet mountain sites on the eastern border of the Transvaal.

Mountains of Southern Japan, Yunan, Korea and Japan. ("Index Floræ sinensis."—Dr. Masters.)

(1) ABIES PINDROW (Abies webbiana).
Himilayan Silver Fir.

Gamble distinguishes this as the Western Himalayan Silver Fir, growing at a lower elevation, and, therefore, the more suitable of the two for the Transvaal. Other authorities make one species of both the eastern (Abies webbiana) and western Himalayan trees. *Abies pindrow* is wonderfully shade-bearing, says Gamble, and this may give it a permanent place in the Transvaal Forestry of the future, in spite of its heavy moisture requirements. Like the European Silver Fir, it runs up to 200 feet in height or, perhaps, 250 feet. Rate of growth somewhat faster than the Himalayan Spruce when young, slower when old. Both the Silver Fir and Spruce should be looked on as subordinate to the Deodar in Transvaal Forestry.

Himalayas, 7,000 to 9,000 feet, particularly in ravines.

(2) ABIES RELIGIOSA.
Oyamel Silver Fir.

Wettest part of the Woodbush or similar range. It is a fine tree, yielding a useful, though not first-class timber. It is the only Abies found in tropical latitudes. It gets its name from the use of the branches to decorate churches. Shows a particularly fine growth on the Italian Lakes; a large tree, 150 feet high near Mexico City.

Southern Mexico and mountains of Guatamala, from 4,000 feet upwards, usually at higher elevations.

(2) ABIES SMITHIANA.—*See* Picea morinda.

(2) ABIES VEITCHII.

Manchuria and Japan; Peling Mountains at 9,800 feet. ("Index Floræ sinensis."—Dr. Masters.)

(1) ABIETIA FORTUNEI.

Fortune's Fir.

A large tree with spreading Cedar-like branches. Fails after some years in England; probably well suited to the Transvaal.

Mountains of Southern China in Transvaal latitudes.

(2) ABIETIA MACROCARPA (Pseudotsuga douglasii).

Douglas Pine (southern form).

The Douglas Pine now represents the biggest stock of timber left in North America. The southern variety, extending to Mexico, is worth trying in the Transvaal. This is the only Mexican Pine not endemic to Mexico. The Californian variety is now being tried at the Cape. The southern varieties, however, are not equal to the northern tree, but the great Oregon tree is quite out of place in the Transvaal.

Northern Mexico.

(2) ACACIA AULACOCARPA.

Hickory Watle.

A hard, dark-coloured cabinet wood. Worth trial.

Widespread in Queensland.

(1) ACACIA BINERVATA.

Binervata Wattle.

A good tan Wattle, nearly as good as Black Wattle. Should be tried first in the north-east forest country of the Transvaal.

East Australia.

(2) ACACIA CATECHU.

Cutch Tree.

Tree with a very hard, durable timber, chiefly valued as yielding cutch, a tan extract. Suited to the warmer parts of the Transvaal.

India.

(2) *ACACIA DEALBATA.*

Silver Wattle.

The well known Silver Wattle, largely planted in the Transvaal. It is somewhat hardier against frost than the Black Wattle, but its chief difference from the Black Wattle is its comparatvie worthlessness for tan work.

South-East Australia.

(1) *ACACIA DECURRENS.*

Black Wattle.

The well known Wattle that has been so largely planted in Natal under the name of *A. mollissima.* In Natal it is planted from the coast right up to the Transvaal, but it is very poor near the coast, and far from its best near the Transvaal border. It grows best in Natal, at elevations between Maritzburg and Colenso, particularly along the so-called

"mist belts." The coastwise limit of good growth is at Inchanga, 2,000 feet elevation, 40 inches rainfall, and about 30 miles from the sea. There are four varieties of Black Wattle, viz., *mollis*, *normalis*, *pauciglandulosa*, and *leichardtii*. The three last occur in Queensland. Two at least of these are growing in Natal. *Mollis* is the commonest in Australia, and that which is almost exclusively planted in Natal and the Transvaal.

East Australia.

(2) ACACIA DORATOXYLON.
Mulga.
Small tree, with a dark-coloured heartwood.
East Australia, inland.

(2) ACACIA EXCELSA.
Ironwood Wattle.
Timber durable and strong. Often a tall tree. Worth trial cultivation in the Transvaal.
South Queensland.

(2) ACACIA FALCATA.
Falcata Wattle.
A small tree with a useful tan bark.
Hillsides in Queensland.

(2) ACACIA FASCICULIFERA.
Fasciculifera Acacia.
An erect tree, up to 80 feet high, with a hard red wood. A useful second-class tree.
Inland Queensland.

(1) ACACIA GLAUCESCENS.
Rosewood.
A tall, erect tree, with fragrant dark timber like Rosewood.
East Australia.

(2) ACACIA HARPOPHYLLA.
Brigalow.
A tall tree, useful for tan bark and timber; latter hard and scented—a good cabinet wood (Bailey). A useful dry-country tree.
East Australia.

(2) ACACIA HOMALOPHYLLA.
Homalophylla Wattle (Myall).
A fragrant, hard wood, too small for timber. A useful dry-country tree.
Inland Australia.

(2) ACACIA IMPLEXA.
Implexa Wattle.
A medium-sized tree, with ornamental white flowers in the middle of summer. Timber useful for cabinet purposes.
Queensland and New South Wales.

(2) ACACIA MACRANTHA.
Cuji Pod Tree.
Pod used for tan.
Mexico.

Acacia melanoxylon (Blackwood), Pretoria.

(1) *ACACIA MELANOXYLON.*

Blackwood.

This well known tree has been successfully planted throughout South Africa. It is seen at its best in Natal, where a small and a large-leaved variety are distinguished, and it grows to a noble tree there. Its straight, rapid growth; its good, natural reproduction and dense covert, mark it as one of the most valuable forest trees for the Transvaal in all the cooler, damper districts. Its timber differs little from walnut. Both at the Cape and Natal it fails sooner or later in dry localities, and seems never to have too much moisture in South Africa, but in Tasmania it is reported as occurring in dry localities.

South and South-East Australia; not in Queensland.

(2) ACACIA PENDULA.
Weeping Myall.
A small tree with drooping, white foliage and violet-scented, handsome wood, prized by cabinet makers. Small tree up to 35 feet high. A tree for the Transvaal dry country.
Marshy ground—interior of Queensland.

(1) ACACIA PENNINERVIS.
Penninervis Wattle.
A good, tan bark Wattle. Small tree up to 40 feet high.
East Australia.

(2) *ACACIA SALIGNA.*
Saligna Wattle.
This is the common tan Wattle of the Cape Flats, where it grows like a weed. As a winter rainfall tree and inferior to the Black Wattle, both in growth and tan percentage, there is no reason for planting it in the Transvaal, though it seems fairly hardy there.
West Australia.

(2) ACACIA STENOCARPA.
Suak Gum Tree.
A large tree.
Abyssinia and Nubia.

(2) ACACIA STENOPHYLLA.
Iron Wood.
Small tree, only worthy of experimental planting in the dry country.
Interior of Queensland.

(2) *ACER CAMPESTRE.*
The common Maple.
A second-rate timber tree, planted with success at Vereeniging. Sample trees elsewhere in the Transvaal.
Northern Africa.

(1) ACER MACROPHYLLUM.
Macrophyllum Maple.
A large tree, usually found near streams. It yields much of the curled and " bird's-eye " Maple that is imported.
North Mexico and U.S.A.

(1) ACER PICTUM.
Pictum Maple.
Elastic timber. A class of timber desirable to cultivate.
Persia and Himalayas.

(1) *ACER PSEUDOPLATANUS.*
Sycamore Maple.
Grows well at Vereeniging on dampish soil. In Mr. Hume's arboretum at Johannesburg it grew 12 feet in five years.
Western Asia.

(2) ACER RUBRUM.
Red Maple.
Worth trying where there is plenty of moisture. It grows naturally in swampy ground. Foliage rather more brilliant in autumn tints than the common Sugar Maple.
Latitude 49° to Eastern Texas.

(2) ACER SACCHARINUM (Wang) of Hough, of Sargent in Census Rep., and of Gamble.
A. barbatum (Mich.) of Sargent in Silva of U.S.A.
A. saccharum (Marsh) of Sudworth.
Sugar Maple.
This tree is the glory of the North American forests, and one of the most valuable trees there. "A noble tree," says Sargent in his great forest flora of North America. It forms pure forest in the north, and grows to a height of 100 or 120 feet. It is the principal sugar maple. The yield of the other sugar maples is of little account. The wood is used for a variety of purposes, but chiefly in its ornamental forms for the interior work of houses. It is a first-rate firewood, and the ashes are particularly rich in potash. In forestry it is notable as a strong shade-bearer. Seed from Texas should be tried on the Woodbush Range or similar wet country in the Transvaal. This tree is one of those most planted in North America, while in Europe it has given disappointing results, and is not now planted except for the ornamental effect of its brilliant autumn foliage. There are several varieties of the Sugar Maple. *Acer barbatum var. nigrum*, the Black Maple, is less likely to suceed in the Transvaal than the common form. It reqiures more moisture. There is a second stunted form in dry Western Texas and Mexico, growing along the banks of streams. A third stunted form, *A. barbatum, var. grandidentatum*, is found on the mountains of Arizona and Utah. These stunted forms are likely to succeed in the Transvaal, but they are not worth growing. There is as much confusion in the botanical name of the Sugar Maple as of the common Spruce. Sargent, in his Silva, uses the name Acer saccharinum for the Silver Maple—a different species.
Eastern damper portions of U.S.A. from Canada to East Texas.

(2) ACROCOMIA MEXICANA.
Palm.
An ornamental Palm.
Mexico, up to 3,000 feet.

(2) AESCULUS HIPPOCASTANUM.
Horse Chestnut.
Nearly always fails completely at the Cape. In Mr. Hume's arboretum at Johannesburg it grew 6 inches in 5 years, and then died. Its climatic unfitness wus shown by its coming into leaf twice, (1) with the spring; (2) with the summer rains.
Balkans.

(2) AESCULUS INDICA.
Himalayan Horse Chestnut.
A beautiful, shady tree, like the common Horse Chestnut. Timber soft, perishable. Suited to the damper parts of the Transvaal only.
North-West Himalayas, from 3,500 to 9,000 feet.

(2) AFZELIA AUSTRALIS.
Australian Afzelia.
A large hardwood timber tree, may be tried in the lower damper districts of the Transvaal.
Queensland.

(2) AGATHIS BROWNII (Dammara brownii).
Brown's Agathis.
Tree 30 feet high in the Riviera.

(2) AGATHIS PALMERSTONI (Dammara p.).
Queensland Kauri.
Timber like a hard deal.
Queensland.

(1) AGATHIS ROBUSTA (Dammara r.).
Queensland Kauri.
Timber like a hard deal.
Queensland, 18° to 26°.

(2) AILANTHUS IMBERBIFLORA.
Queensland Ailanthus.
A large tree with light porous wood that may prove useful in the low country.
Queensland, near Rockhampton.

(2) ALBIZZIA JULIBRISSIN.
Rose Silk Acacia.
Handsome flowers. Not found in the drier climate of the Inner Himalayas. Very ornamental with large flower heads of fine rosy red stamens (Brandis).
South Europe.

(2) ALBIZZIA LEBBEK.
Lebbek Acacia.
The Cairo avenue is of this tree, whence Mr. Rhodes sent cuttings to Salisbury. It furnishes from India " burr " wood for the London market. Quick growing. Planted extensively. A poor tree in Botanical Gardens, Durban. Found wild in Central Africa.
Western Himalayas, to 5,000 feet ; widely cultivated.

(2) ALBIZZIA ODORATISSIMA.
Odoratissima Albizzia.
A handsomer tree than A. lebbek, but perhaps more tender to drought. Wood very hard and of only medium durability. Lower districts only.
Himalayas, East of Indus to 3,000 and rarely 5,000 feet.

(2) ALIBERTIA EDULIS.
Marmeladinha Fruit Tree.
Eastern Transvaal only.
Extra-Tropical Brazil.

(2) ALNUS ACUMINATA.
Alder.
Near streams only. A small tree at best.
Mexico.

(2) *ALNUS GLUTINOSA.*
The Common Alder.
May be worth introducing near streams. Naturalised at the Cape, but of little value there. Looks poor in the Pretoria Park.
Europe and Extra-Tropical Asia.

(2) *ANGOPHORA LANCEOLATA.*
Angophora.
A useful shade tree. I saw several well-grown specimens both in Natal and in the Transvaal.
East Australia.

(2) *ANGOPHORA SUBVELUTINA.*
Angophora.
A large shade-giving tree. Timber mediocre. Sample trees may be tried in the milder parts of the Transvaal.
Queensland and New South Wales.

(* 1) *ARAUCARIA BIDWILLI.*
Bunya-bunya.
Fine tree with eatable nut ; has a good durable building timber ; best suited to the forest country of north-east Transvaal, and perhaps the low country. A tall, handsome tree, bearing good crops of nuts the size of acorns in the middle districts of Natal. Fair growth, Tophams, near Maritzburg, Natal. I saw several remarkably healthy young trees in the Pretoria Park and in various Johannesburg gardens.
Queensland.

(1) *ARAUCARIA BRASILIANA.*
Araucaria.
Sensitive to drought in the Transvaal. Pine-like timber. A five-year-old tree in Mr. Hume's arboretum, Johannesburg, was 12 feet high, but looked rather pinched with drought in Spring. It may be well worth growing as a timber tree on the Woodbush Range.
Southern Brazil, up to 3,000 feet.

(1) ARAUCARIA COOKII. (A. *columnaris*, Hook.)
Cook's Araucaria.
This is one of the noblest of the Araucarias, running up to 150 or 200 feet on its native mountains. It is well worth trial on wet mountain ranges near the coast of the eastern Transvaal, where it may prove hardier than the common Norfolk pine.
Mountains of New Caledonia.

(1) *ARAUCARIA CUNNINGHAMII.*
Moreton Bay Pine.
Pine-like timber. A lofty tree, up to 200 feet. The most widely distributed of all the Australian Araucarias. Grown successfully all through Natal, but best near the coast and middle regions. Suited to the wetter, warmer parts of the Transvaal. I saw a well-grown tree at Athole, on the Swazie border.
Eastern Australia, lat. 14° to 32°; coast and 80 miles inland. Mountains of New Guinea, 5,000 feet.

(2) *ARAUCARIA EXCELSA.*
Norfolk Island Pine.
Good timber. Only suited to the warmer yarts of the Transvaal. Suffers from frost in Pretoria. Not a long-lived tree in the Cape Peninsula.
From the mountains of Norfolk Island, which rise to an elevation of 1,000 feet, to the Isle of Pines, a mere sandbank off New Caledonia. Widely culivated in extra tropical regions.

(2) *ARAUCARIA IMBRICATA.*
Puzzle Monkey.
This stands the frost of the Transvaal, but it is a winter rainfall tree, and grows very slowly in the Transvaal.
Lower Andes of Chili.

(2) ARAUCARIA MONTANA.
Mountain Araucaria.
Worth trial in the lower, wetter districts.
New Caledonia.

(2) ARAUCARIA RULEI.
Rule's Araucaria.
A small Araucaria, 50–60 feet, much cultivated in Australia for its picturesque look. Barberton and lower districts only.
New Caledonia, on mountains.

(* 1) ASPIDOSPERMA QUEBRACHO.
Quebracho Colorado, Red Quebracho.
Has a very hard, durable timber, well suited for sleepers. Tan extract made from the timber. Should be tried in the Barberton district. A very valuable tree, but I fear slow-growing. Said to take about a century to mature, when the average height is from 80 to 100 feet. Quebracho sleepers are almost imperishable as regards decay.
Warmer parts of the Argentine—Chaco.

(2) ATALANTIA GLAUCA.
Wild Lime.
Fruit good enough to preserve.
Inland Queensland.

(2) BACKHOUSIA CITRIODORA.
Scented Backhousia.
A small tree with scented leaves.
Southern Queensland.

(2) BACTRIS GASIPÆS.
The Peach Palm.
Yields a chestnut-like fruit. May be tried about Barberton, or perhaps higher.
Warm, temperate slopes of Andes.

(1) BAMBUSA ARUNDINACEA.
Thorny Bamboo.
The common large bamboo of the Mysore plateau and Southern India. ("A magnificent species."—Gamble). Only suited to the lower, wetter districts of the Transvaal, though, according to Kurz, it stands drought better than others of the large species.
Southern India, up to 4,000 feet.

(1) *BAMBUSA BALCOOA.*
Cape Bamboo.
Growing well in the Eastern Transvaal. Cultivated widely in S.A.
Himalayas.

(2) BARKLYA SYRINGIFOLIA.
Barklya.
A medium-sized, very beautiful tree, with deep yellow flowers. Lower, damper districts.
Southern Queensland.

(2) BAUHINIA CARRONII.
Queensland Ebony.
Medium-sized tree, with wood that is hard, heavy, fine-grained, and dark-brown in the centre. Might be tried at Rustenburg and the lower inland districts.
Interior of Queensland.

(2) BAUHINIA HOOKERI.
Queensland Ebony.
Medium-sized tree, with a dense head of foliage. Lower districts of the Transvaal.
Queensland interior.

(1) *BELIS JACULIFOLIA* (Cunninghamia sinensis).
Belis.
I saw one quite successful specimen in Mr. Hume's arboretum at Johannesburg. At five years old it was 14 feet high. It is a tall, erect tree in China, and is well worth cultivating in the Transvaal. Unlike the Araucarias, it is hardy against frost and drought; and, unlike most conifers, it sends up suckers from the root and re-shoots when cut. A tree found chiefly in mountain valleys; its timber is used for planking.

Formosa and various parts of China (A. Henry). The timber is Pine-like. It has been introduced to Japan, and is seen there in both forests and gardens. Belis jacufolia (Salisbury), as Masters points out, is the older and more correct name. Cunninghamia sinensis (R. Brown) is the one most in favour with gardeners; but the latter name is liable to be confounded with quite another tree, viz., Araucaria cunninghamii of Queensland. Those who prefer the name Cunninghamia do so on the ground that "Belis" may be confounded with "Bellis," the botanical name of the Daisy.

South China, Yun-nan, etc. (Yun-nan is a plateau north of Burmah, 5,000 to 8,000 feet elevation, and a climate resembling the Transvaal.)

(2) BETULA ALBA.
Birch (common).

Perhaps worth growing, for ornament only, in the Transvaal. It does fairly as an arboretum tree in the west of Cape Colony, and at Fort Cunningham, in the east of Cape Colony, it grew 40 feet in three years. Looks poor in the Pretoria Park. It is not an easy tree to raise from seed.

Europe.

(2) BETULA ALNOIDES.
Himalayan Birch.

A large leaf-shedder. The common Birch of the Himalayas. Timber held to be durable by some. Worth trial in the Woodbush Range.

Himalayas, 3,000 to 10,000 feet.

(2) BROUSSONETIA PAPYRIFERA.
Paper Tree.

Cultivated largely in Japan and elsewhere. The inner bark yields a good paper and fibrous cloth. Does best under irrigation and in a mild climate.

China.

(2) BURSERA ELEMIFERA.
Copal Tree.

It may be worth growing for its copal in the Transvaal.

Mexico, up to 5,000 feet elevation.

(2) CALLISTEMON LANCEOLATUS.
Red Bottle Brush.

Worth growing for its brilliant flowers, varying from pink to crimson colour. Wood durable and hard. Several other Callistemons have equally brilliant red flowers.

Queensland, in beds of rivers.

(* 1) CALLITRIS CALCARATA.
Calcarata Callitris.

Wood scented, durable, and Cedar-like, but with the colour of Stinkwood. Not fast growing, but yielding first-rate timber that is both ornamental and very valuable—in fact, the handsomest timber in the Kew Museum.

East Australia.

(2) CALLITRIS COOKII.
Cook's Callitris.
A handsome small shrub with a bluish sheen in Mr. Hume's arboretum, Johannesburg.

(1) CALLITRIS MACLEAYANA.
Turpentine Cypress.
Yields a valuable Cedar; timber light, easily worked and durable. Rate of growth probably slow. May be tried at Potchefstroom.
East Australia.

(2) CALLITRIS PARLATOREI.
Parlatore's Callitris.
Durable, Cedar-like wood. This valuable timber tree reaches to a height of 100 feet in a good rainfall. Will do best in the lower districts, Barberton, etc.
South Queensland.

(* 1) *CALLITRIS ROBUSTA* (*C. verrucosa*).
Murray Cypress.
Cedar-like wood, about as heavy as Teak, and quite as durable. Tree generally slow-growing. This is probably the best Callitris for the Transvaal. It should be tried in all the drier plantations. It is probably this species that has grown so well in the Pretoria Park, and been so badly treated.
Inland Australia, wide-spread.

(2) CALLITRIS WHYTEI.
M'lanji Cedar.
May be tried in the north-east forest country of the Transvaal. It soon fails at the Cape.
Mountains of North Rhodesia and hills of South Rhodesia.

(2) *CALODENDRON CAPENSE.*
Cape Chestnut.
A common tree in the indigenous forest of South Africa, generally at the lower elevations. It is sometimes planted both at the Cape and Natal. It makes a most effective and handsome ornamental tree, and should be more largely planted for this purpose.
Cape, Eastern District, thence to north-east Transvaal and beyond.

(2) CASIMIROA EDULIS.
Mexican Apple.
Tall tree, yielding a small fruit.
Mexico, up to 7,000 feet.

Castanea vesca (Young Sweet Chestnut), Johannesburg.

(1) *CASTANEA VESCA.*

Sweet Chestnut Tree.

The well known tree. It grows fairly in Johannesburg as a young tree, and may be seen occasionally in other parts of the Transvaal; but it has not yet been proved to be long-lived and hardy in the Transvaal. It gave rather doubtful results at Athole, New Scotland, in the Transvaal.

South Europe.

(2) CASTANOSPERMUM AUSTRALE.

Moreton Bay Chestnut.

Timber like Walnut. Foliage, however, is in Australia reputed *poisonous to stock.* Barberton and lower districts only. A poor tree in Durban Botanical Gardens.

Queensland.

(2) CASUARINA CUNNINGHAMIANA.

Beefwood.

A tall tree growing near rivers on mountain slopes. Trial planting only.

East Australia.

(1) CASUARINA DECAISNEANA.

Beefwood.

Large tree, with durable, hard timber, but very slow-growing. Suited to the driest parts of the Transvaal.

Central Australia.

(1) CASUARINA GLAUCA.

Desert Beefwood.

Suitable for the driest and warmest inland districts of the Transvaal on the Bechuanaland and north-west borders. It is said to be fast-growing, and to have durable timber.

Interior of East Australia.

(1) *CASUARINA SUBEROSA* (var. leptoclada).

Beefwood.

Forms nearly pure forest. Timber hard, not durable. The common Casuarina of Pretoria, Johannesburg, and other towns in the Transvaal; a handsome shade tree, but of little timber value, and curiously, both in the Transvaal and at the Cape, it is generally a failure when planted close in timber plantations, or when left to itself on the veld.

East Australia.

(2) CASUARINA TORULOSA.

Beefwood.

A small, shade-giving handsome tree.

Queensland.

(2) *CATALPA BIGNONIOIDES.*

Catalpa.

So far as I have seen this tree in the Transvaal, it does not grow large enough or with enough bole to make a profitable timber tree. It does better in the Transvaal than at the Cape. This is a smaller tree than C. speciosa, but perhaps hardier.

North America.

(2) *CATALPA SPECIOSA.*
Catalpa.
Commonly planted in the Transvaal, but probably only worth planting there as an ornamental tree, unless near water. Good durable, soft timber.
Southern States, U.S.A.

(2) *CATHA EDULIS.*
Catha Tea Tree.
A shrub, yielding tea.
Arabia.

(1) CEDRELA ANGUSTIFOLIA.
Cedar.
Should be well tried in the Transvaal.
Peru.

(2) CEDRELA BOGOTENSIS.
Cedar.
Should be tried on the Woodbush or similar Range.
Nicaragua, to 8,000 feet.

(2) CEDRELA FEBRIFUGA.
Cedar.
Closely allied to Cedrela toona of Australia, and probably more tender to drought than the Australian tree.
Java, Sumatra, Timor Mountains.

(1) CEDRELA FISSILIS.
Acajou Wood.
A durable, scented Cedar wood. A very valuable tree, but probably too tender for elevations above Barberton.
Mexico.

(1) CEDRELA MONTANA.
Cedar.
Lower, wetter parts of the Transvaal only; a first-rate timber.
Venezuela Mountains.

(1) CEDRELA ODORATA.
Cedar.
Grows well at Durban. Should be tried in the lower districts of the Transvaal.
Mexico, etc.

(1) CEDRELA PARAGUENSIS.

Cedar.

May be tried in the wetter districts.

Argentine.

(* 1) CEDRELA SERRATA.

Cedar.

A first-rate timber tree, which may prove hardier in the Transvaal than Cedrela toona. Weighs 33 lbs. per cubic foot, and is fast growing. (Gamble.) It may be tried at about 4,000 feet elevation on the Woodbush Range. Grows in damp, shady valleys up to 8,000 feet in the Outer Himalayas. (W. R. Fisher.)

Punjab Himalayas.

(1 *) CEDRELA SINENSIS.

Cedar of China.

Should be well tried on the colder, damper parts of the Transvaal, such as Belfast, where it may prove a most valuable introduction.

China and Japan.

(* 1) CEDRELA TOONA.

Toon of India, *Red Cedar* of Australia.

The most valuable timber tree in all Australia. Should do well in the lower, warm valleys of the Woodbush Range. The seed is difficult to procure good, but repeated trials should be made, and wherever good results are obtained, this most useful tree should be largely planted.

India and East Australia.

(1) CEDRELA VELLOZIANA.

Cedar.

A fine tree with first-rate timber, but only suitable for the wettest parts of the Transvaal, say the Woodbush Range.

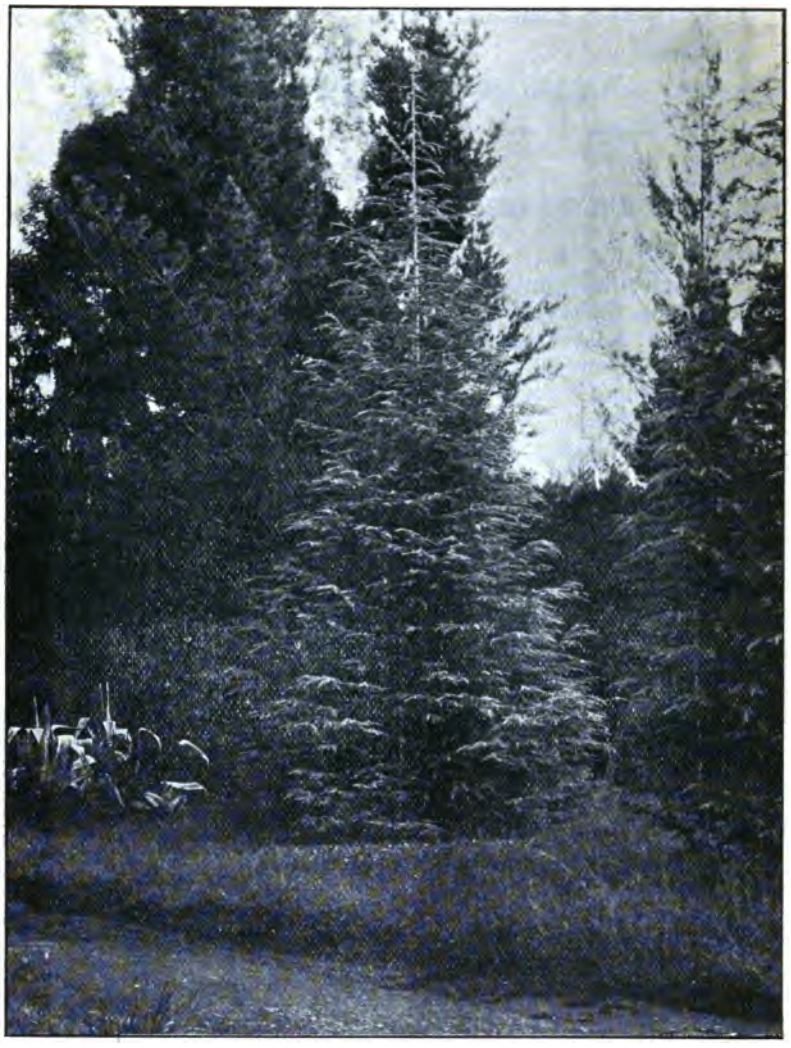
Brazil.

(2) *CEDRUS ATLANTICA.*

Atlas Cedar.

Inferior to Deodar in growth, but perhaps worth trial planting. Climatically unsuited to the Transvaal.

Atlas Mountains, 4,000 to 6,000 feet,



Cedrus deodara (Deodar), Irene.

(1 *) *CEDRUS DEODARA.*

Deodar.

Grows splendidly all over the Transvaal. One of the first timber trees of the world. Timber, a Cedar. This tree will do best in the wetter districts, but I have never seen it fail in any part of the Transvaal, and it may be safely planted in millions. It may, in Transvaal Forestry, occupy the position of the Oak in European Forestry. There are numerous well-grown specimens of this tree in Natal.

Drier slopes of outer Himalayas, less abundant on inner slopes beyond south-western summer rains; 4,000 to 10,000 feet.

(2) CEDRUS LIBANI.
Cedar of Lebanon.
Inferior to Deodar in growth, but worth trial planting.
Taurus Mountains, 3,000 to 6,000 feet.

(2) CEPHALANTHUS OCCIDENTALIS.
A flowering tree of U.S.A. and Mexico.
Mexico.

(2) CEPHALOTAXUS DRUPACEA.
Cow's Tail Pine.
It grows up to diameters of six feet, and is found from the southern coast of Corea northwards. Dr. Masters in the "Index Florae Sinensis" mentions four other Chinese species of Cephalotaxus.

(2) *CERATONIA SILIQUA.*
Carob.
Climatically an exotic in the Transvaal, but growing well, so far, in several places, the best I saw being in Woodbush Village. Yields the sweet Carob pods. It would probably do best in the drier parts of the Transvaal, with a little water in the winter at the roots. In Natal the summer rains spoil the pods in some places.
Mediterranean.

(2) CEROXYLON ANDICOLA.
Wax Palm.
A majestic, hardy palm, well worthy of trial in the North-East Transvaal. Yields wax. Grows up to snow level on the Andes.
Andes, to 11,000 feet.

(2) CHAMÆDORA ELATIOR.
Palm.
One of several ornamental palms growing in the warmer temperate plateau of Mexico. Probably well suited to the lower districts of the Transvaal.
Mexico, 4,000 to 5,000 feet.

(2) CHUSQUEA CULEOU.
Bamboo.
May be hardier than the larger, more valuable bamboos.
Chili and Argentine.

(* 1) *CINNAMOMUM CAMPHORA.*
The common Camphor tree.
I saw various well-grown Camphor trees both in the Transvaal and Natal, particularly in Natal. Its habitat, China and Japan, enables it to withstand much frost. It stands all but the worst frost of Pretoria, of Irene, and of the lower Karoo in Cape Colony and of Northern Italy, but it is seen at its best in a semi-tropical climate. It tends to grow bushy in the open. Its forestral place in the Transvaal is under half shade on the Woodbush Range. Here it should be largely employed in the replanting required to restore the worked-out forest. Afterwards it would probably spread there self-sown.
China, Japan, etc.; widely cultivated.

(2) COCOS AUSTRALIS.
Palm.
A hardy, extra-tropical Palm ; ornamental.
Argentine.

(2) COCOS FLEXUOSA.
Palm.
A hardy, extra-tropical Palm ; ornamental.
Brazil.

(2) COCOS PLUMOSA.
Palm.
A hardy, extra-tropical Palm ; ornamental.
South Brazil.

(2) COCOS YATAY.
Palm.
A hardy, extra-tropical Palm ; ornamental.
Argentine.

(2) COPERNICIA CERIFERA.
Palm.
A hardy, extra-tropical Palm ; ornamental.
Bolivia.

(2) CORYLUS AVELLANA.
Cob-nut tree.
Has been grown to a small extent in the Transvaal and in Natal.
North Africa.

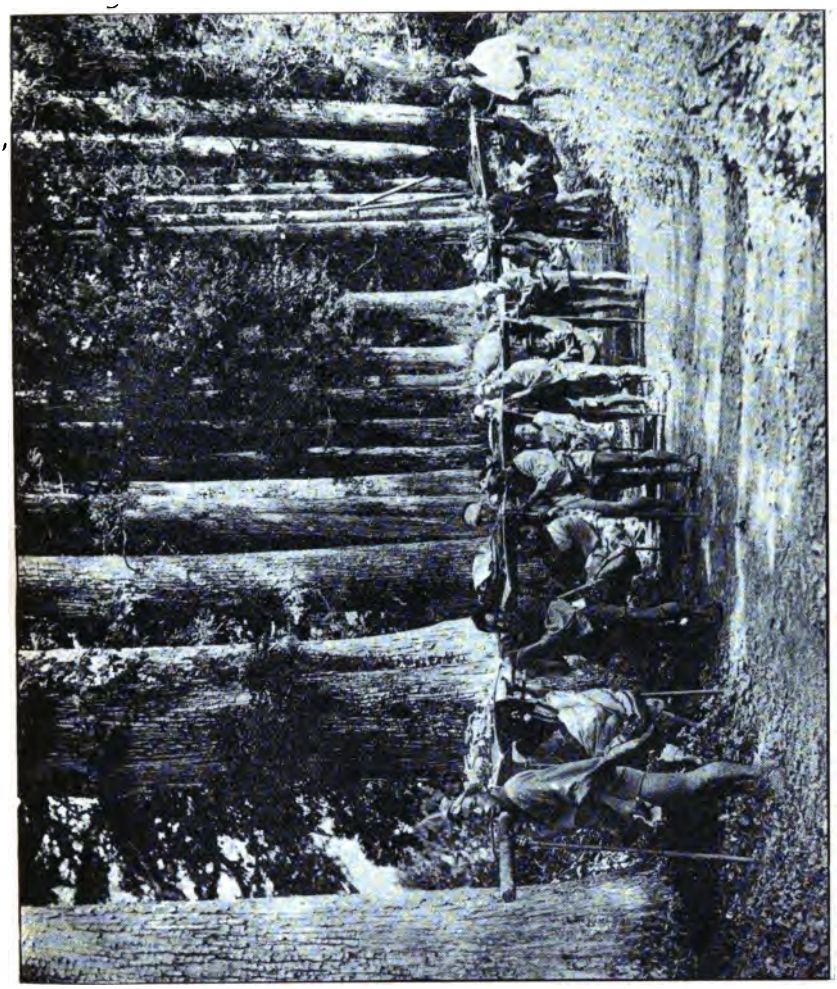
(1) CORYLUS COLURNA.
Cob-nut tree.
Wood handsome and not warping. Nuts equal to the English cob (Gamble). The Himalayan nut tree should be well tried in the Transvaal.
Greece and West Himalayas, 5,500 feet.

(2) CRATÆGUS MEXICANA.
Mexican Hawthorn.
Has a large eatable fruit.
Mexico.

(2) CRYPTOCARYA GLAUCESCENS.
Cryptocarya.
A tall tree, with a useful, easily worked timber
Queensland, widespread.

(2) CRYPTOCARYA OBOVATA.
Cryptocarya.
A tall tree, with a useful, easily worked timber
Queensland, widespread.

(2) CRYPTOCARYA TRIPLINERVIS.
Cryptocarya.
A tall tree, with a useful, easily worked timber.
Queensland, widespread.



CRYPTOMERIA AVENUE IN JAPAN.

(1) *CRYPTOMERIA JAPONICA.*

Japanese Cedar.

I saw various fine trees in Natal, particularly in the forest country near Kar Kloof (Belgowan Railway Station, 3,000 feet elevation). This is a noble tree in Japan. It would do well in the damp north-eastern forest country of the Transvaal. Grew 55 feet high in 10 years at Hilton Road, Natal. There are some fair-sized trees in the Pretoria Park, but they are not quite healthy, and in one case were badly attacked by white ants. Japan and China, particularly Yanan.

(1) CUPRESSUS BENTHAMI.

Bentham's Cypress.

Differs little from Cupressus thurifera, but has a colder habitat. Cedar-like timber. Should be carefully tried in the various mountain districts of the Transvaal.

Mexico, in the cold mountain region, 6,000 to 9,000 feet.

Cupressus funebris, Pretoria.

(2) *CUPRESSUS FUNEBRIS.*

Funebris Cypress.

This should be tried in the Transvaal, but more as an ornamental than a timber tree. I saw several young healthy trees, averaging 9 inches diameter and 40 feet high, at Athole, New Scotland, and somewhat smaller trees in the parks at Johannesburg and Pretoria. One of the most beautiful trees in China. ("Index Florae Sinensis."—Dr. Masters.)

Himalayas and Northern China.

(1) *CUPRESSUS GLAUCA.*

Cedar of Goa.

Cedar-like timber. Seems to do well in Mr. Hume's collection at Johannesburg. *See* Cupressus lusitanica.

South Europe.

(2) *CUPRESSUS GOVENIANA.*

Goven's Cypress.

Climatically not suited to the Transvaal, and only a small tree in its own country. I saw healthy-looking young trees at Ermelo.

California.

(1) *CUPRESSUS GUADALUPENSIS.*

Guadalupe Cypress.

Like Macrocarpa Cypress, but stands drought better. Timber, a Cedar. Should be preferred to the Macrocarpa Cypress, especially in the drier districts of the Transvaal.

California and Arizona.

(1 *) CUPRESSUS LINDLEYI.

Lindley's Cypress.

Valuable timber. A fine tree allied to C. benthami and C. thurifera. Should be tried in the north-eastern districts at the higher elevations.

Mexican Mountains.

(1 *) *CUPRESSUS LUSITANICA.*

Portuguese Cypress or Cedar of Goa.

This is one of the finest of the Cypresses; trees up to 60 feet high in the Botanical Gardens at Mazitzburg, and one of the best of the Cypresses in Cape Colony. But it is only well suited to quite the dampest parts of the Transvaal. I saw several healthy-looking young trees (about 15 feet) at Ermelo, and some particularly fine trees, ranging up to 60 feet in height, at Athole, on the Swazie border. Under these fine trees were numerous self-sown seedlings. There was a similar good growth and natural reproduction in the park at Pretoria. There are some very handsome erect trees with tall, tapering stems at Irene. It showed the best growth of all the conifers in Mr. Hume's collection at Johannesburg, 10 trees, six years old, there averaged 25 feet in height. The origin of this tree is unknown. Portugal has the largest trees. There are fine forests at Busaco, but the Portuguese botanists consider it to

have been originally introduced. It does not, however, occur in the wild state either near Goa or Macao. Cupressus sinensis is a gardener's name for this tree, and Cupressus pendula glauca a garden variety. (Masters in Jour. Lin. Soc., June, 1896).

Portugal.

(1) CUPRESSUS PISIFERA.

Pisifera Cypress.

Very like C. obtusa, but with a wider habitat. It does better as an introduced tree. In Japan it grows to a larger size than C. obtusa. In Europe these dimensions are reversed. In Japan the timber is considered somewhat inferior to C. obtusa. Woodbush Range or a similar damp climate.

Japan and China.

(1) CUPRESSUS OBTUSA.

Obtusa Cypress.

A straight-growing, large tree. Though extinct as a wild tree, it is abundant as a planted tree all over Japan. Its timber is the best in Japan for the interior finish of houses; also for lacquer work. It is very highly esteemed in Japan (Veitch). It likes an open, loamy soil, and is said to die out in calcareous soils. Woodbush Range or a similar damp, mountain climate.

Japan.

(1 *) *CUPRESSUS SEMPERVIRENS.*

Common Cypress.

Already growing well all over the Transvaal. First-rate timber. Perhaps only second to the Deodar in the future forestry of the Transvaal. The open growing variety only should be planted. Persian seed seems to give the best trees in South Africa.

Persia and Mediterranean. Masters gives Northern Persia, Syria, and Asia Minor as the habitat of this tree, and in his paper on the "Coniferæ of China" indicates it as sub-spontaneous in Yunan, China.

CUPRESSUS SINENSIS.—*See* Cupressus lusitanica.

(1 *) CUPRESSUS THURIFERA.

White Cedar.

Timber valuable. A most promising tree, especially for the north-eastern forest country. Does well in South European Botanical Gardens.

Mexico, 4,000 feet.

Cupressus torulosa (Himalayan Cypress), Pretoria.

(1) *CUPRESSUS TORULOSA.*

Torulosa Cypress.

A first-rate timber, more durable in the ground than Deodar. Easily propagated. Patchy distribution in the Himalayas; seems to prefer limestone. Should be first tried in the north-eastern forest country on a large scale. Must have abundant moisture to do well. I noticed a quite healthy young tree at Ermelo. Attains 150 feet in Kumaon (8,000 feet) with a rainfall of 150 inches!

Outer, wetter, Western Himalayas, 3,500 to 8,000 feet.

(2) *CYPHOMANDRA BETACEA.*

Tree Tomato.

Already grown with success at Athole, on the Swazie border and elsewhere; it bears abundance of good fruit.

South America to lat. 34°; cultivated widely.

(1) DALBERGIA MISCOLOBIUM.

Miscolobium jacaranda.

One of the trees that furnish the Jacaranda wood. Only suited to the Woodbush Range or similar damp localities in the Transvaal.

Southern Brazil.

(1) DALBERGIA NIGRA.

Jacaranda wood tree.

One of the trees that furnish the Jacaranda wood. Only suited to the Woodbush Range or similar localities in the Transvaal.

Southern Brazil.

(*1) DALBERGIA SISSOO.

Sisu.

A first-rate timber tree; a tall, rapid-growing leaf-shedder. More planted than any other tree in India, after Teak. Timber strong, durable, seasoning well, but somewhat heavier than Teak. Root bitter, untouched by white ants. Sisu will be best suited for the lower districts, but should succeed in the lower valleys of the north-eastern forest country.

Himalayas, to 5,000 feet.

(2) DAPHNANDRA MICRANTHA.

Australian Yellow-wood.

A tall, handsome tree, with a useful indoor timber. Try at lower elevations, indigenous forest, north-eastern Transvaal.

New South Wales.

(1) DENDROCALAMUS STRICTUS.

Common Bamboo of India.

Of 150 million stems estimated to be cut yearly in India, 100 million come from this species. It grows in leaf-shedding forest. Best suited to the warmer parts of the indigenous forest in the north-eastern Transvaal, but may grow well elsewhere.

India, extending to Burmah.

(2) DIOSPYROS KAKI.

Persimmon

A fruit that is highly prized in Japan, and that should do well at lower elevations in the Transvaal. Succeeds under irrigation at Durban.

China and Tropical Asia.

(2) DIOSPYROS PENTAMERA.
Grey Plum of New Wales.
A tall tree with mediocre timber. Test planting only in the warmer, better watered districts.
Queensland and New South Wales.

(2) DIOSPYROS TEXANA.
Mexican Persimmon.
Small, insipid fruit. Wood a good box substitute. Should be quite hardy in the Transvaal.
Texas and North Mexico.

(2) DRACÆNA DRACO.
Dragonblood Tree.
A vegetable curiosity.
Canary Islands.

(2) DUBOISIA MYOPOROIDES.
Corkwood.
A small tree, worth test cultivation, Barberton and low country.
Queensland.

(1) DYSOXYLON FRASERIANUM.
Pencil Cedar.
A large, handsome tree, with valuable timber. May be tried in the lower warmer valleys of the north-eastern forest country.
Queensland.

(1) DYSOXYLON MUELLERI.
Pencil Cedar.
A tall tree; timber used for cigar boxes. May be tried in the lower, warmer valleys of the north-eastern forest country.
Queensland.

(2) ECHINOCARPUS AUSTRALIS.
Maiden's Blush.
Wood pinkish, suitable for flooring boards. May be tried in the lower, warmer valleys of the north-eastern forest country.
Queensland.

(2) ERYTHRINA ZEYHERI.
Kaffir Coral tree.
This tree, with its gorgeous red flowers in spring on its leafless branches, is a brilliant and remarkable spectacle. Large trees are very common on the Natal coast, and less common on the eastern coast of Cape Colony. Smaller trees dot the open bush veld of the northern Transvaal. It has little value as a timber tree. Used as live fence pole like Willow in Rustenburg and other districts.
East Africa.

(1) ERYTHROXYLON COCA.
The Cocaine Shrub.
Yields cocaine, which is perhaps the best of the stimulating drugs, and superior to alcohol. Forty million pounds of the leaves, worth £2,000,000, now yearly produced in South

America. It is cultivated to some extent in India. It may do well in the North-Eastern Transvaal, and is a most valuable cultivation. Peru, Andes, and Bolivia.

(2) EUCALYPTUS ACMENOIDES.
Acmenoides Gum.

One of the commercial timbers of New South Wales and Queensland. Maiden compares it to Tallow wood. It is, however, without the greasy nature of Tallow wood, and harder. Very durable in the ground, but liable to crack and split when cut up. Damper parts of the Transvaal only.

Northern New South Wales and Queensland; coast and coast mountains. Dry hillsides and mounatin ranges north of Sydney.

(2) *EUCALYPTUS AMYGDALINA* (*var. linearis*).
Narrow-leaved amygdalina.

This is worth growing as an ornamental tree. It has the quick growth of a gum, but quite slender, drooping leaves, differing from most gums. It is hardy against frost, and there are good specimens of the tree both in Natal and the Transvaal. notably at Saxonwald, Johannesburg. East Australia.

(2) EUCALYPTUS BEHRIANA.
Behriana Gum.

Mueller describes this as shrubby, but in the interior of New South Wales it is a good size " Box " tree. It seems well-suited to and is worth trying in the Western Transvaal in the Potchefstroom, Lichtenberg, and Rustenburg districts.

Interior of New South Wales.

(2) EUCALYPTUS BICOLOR (E. largiflorens of Mueller).
Bicolor Box.

This is a second-rate gum, only worth planting in the country too dry for the Iron-barks. In the very dry country of the interior of Australia it becomes dwarfed to a bush.

Inland Eastern Australia.

(1) *EUCALYPTUS BOTRYOIDES.*
Botryoides Gum.

Timber hard, strong, and durable, but cuts up badly. Already growing well in the parks and in various plantations in the Transvaal. An inferior growth at Wilkinson's, near Maritzburg, in Natal. Good growth at the Cape.

Eastern Australia.

(1) *EUCALYPTUS CITRIODORA.*
Scented Gum.

Timber of good shape and quality. May be seen in various parts of the Transvaal, but only well suited to the lower districts. It is tender to frost and drought.

Queensland.

(2) EUCALYPTUS CONICA.
Conica Gum.

This is one of Deane and Maiden's new species. It is worth trying at Potchefstroom and the Western Transvaal.

Interior of New South Wales, generally on low-lying ground.

Eucalyptus coriacea (Leather Gum) on right;
Eucalyptus globulus (Blue Gum) on left; Irene.

(2) *EUCALYPTUS CORIACEA* (E. pauciflora of Mueller). *Leather Gum.*

This tree has been planted to some extent in the Transvaal and Orangia on account of its resistance to frost. The inferiority of its timber excludes it from timber plantations. The finest specimen of this tree known in the Transvaal is at Irene, a tree 20 inches in diameter and 50 feet high. It is a striking Eucalypt, with its smooth white bark, yellowish twigs, and thick leaves with their peculiar veins.

Eastern Australia.

(2) *EUCALYPTUS CORYMBOSA.*

Bloodwood.

Timber durable in the ground, but wasteful to cut up owing to gum veins. I have seen only one tree in the Transvaal, in Mr. Forbes' collection at Athole; not a large tree. Grew well at Wilkinson's, near Maritzburg, Natal—about 60 feet in 16 years.

Eastern Australia.

(2) *EUCALYPTUS CORYNOCALYX.*

Sugar Gum.

This is a tree of the drier inland districts of Southern Australia and Victoria. It rejoices in a climate of scanty winter rains and does poorly in the eastern districts of Cape Colony. In Natal its growth is uncertain. I found, however, some healthy trees at Pietersburg in the Northern Transvaal.

Southern Australia.

(*1) *EUCALYPTUS CREBA.*

Iron-bark.

A first-rate timber, one of the Iron-barks, very durable in the ground. In America said to stand extremes of drought, heat, and cold, better than the other Iron-barks; but in Cape Colony it is inferior in growth to the Paniculata and Siderophloia Iron-barks. Its timber, however, is always straight, and cuts up well. A fine tree on the Natal coast. This in the northern part of New South Wales has a wide extension inland over the dry plateau country. It is one of the best, if not the best, Iron-bark for the Transvaal.

Eastern Australia.

(2) EUCALYPTUS DEALBATA.

Stanthorpe's Messmate.

A medium-sized drought-resistant tree. Timber durable, but cuts up badly. Lower elevations only in the Transvaal.

Inland Queensland.

(2) *EUCALYPTUS DIVERSICOLOR.*

Kari.

This tree, though quite a climatic exotic, may be seen growing fairly in the Transvaal and well in Natal. What age it will reach in each place, and what will be the quality of its timber, are questions which can only be settled experimentally by the curious. The practical man will prefer to spend his money on trees which are not climatic exotics.

Western Australia.

(2) EUCALYPTUS EXSERTA.

Exserta Gum.

A medium-sized tree with durable timber (Bailey). Tender to frost.

Queensland, on inland rivers.

(1) *EUCALYPTUS GLOBULUS.*

Blue-Gum.

Though a climatic exotic in the Transvaal, the Blue Gum grows so rapidly in the wetter, cooler parts of the country that, where a bulk of coarse timber is required, it may be the most profitable tree to plant. Nearly all the South African Blue-Gum timber is of inferior quality, seasoning badly, and decaying rapidly in the ground. And generally another Eucalypt can be found that is not a climatic exotic, that will yield a good timber, and that will grow as fast as the Blue Gum. Of such in the Transvaal are E. saligna and E. botryoides, which may be seen flourishing from Johannesburg downwards, especially in Pretoria. There are Blue-Gum trees up to 200 feet in height both in Cape Colony and Natal.

Tasmania and South-Eastern Australia.

(2) EUCALYPTUS GRACILIS.

Gracilis Gum.

A small tree with durable timber (Bailey). This may be useful for the lower western districts of the Transvaal.

Australia, inland ; widespread.

(*1) EUCALYPTUS HEMIPHLOIA.

Grey Box.

A good strong timber, durable, prized for sleepers in Victoria. Slow growing, but probably well suited to the drier parts of the Transvaal. Best developed in the coast districts, but widely spread over the interior plateau country of New South Wales, particularly the white, large, fruited variety known as "Albens."

Eastern Australia.

(2) *EUCALYPTUS LEUCOXYLON.*

Leucoxylon Gum.

A winter-rainfall tree, and out of place in the Transvaal. I saw a few healthy young trees in the streets of Pietersburg.

Southern Australia.

(2) EUCALYPTUS LONGIFOLIA.

Longifolia Gum.

Good growth in middle districts of Natal. A straight-growing, good timber, worth trying in the Transvaal.

South-Eastern Australia.

(1) EUCALYPTUS MACULATA.

Maculata Gum.

A handsome, strong-growing, large-leaved Gum. Elastic timber, but of rather uncertain durability in the ground, and perhaps tender to drought in the Transvaal, though it stands drought on the mountains of the south coast, Cape Colony.

Southern New South Wales.

(2) EUCALYPTUS MELANOPHLOIA.
Silver-leaved Iron-bark.

A small, crooked tree, but hardy against drought. Durable timber.

Queensland, inland.

(2) EUCALYPTUS MELLIODORA.
Yellow Box.

A durable, hard wood, but scarcely worth growing except in the drier inland districts; wood too liable to crack to be sawn up. A medium-sized tree, with pale-coloured timber, "Much esteemed," says Maiden, 'for strength and durability." It is usually found as a handsome tree with more or less drooping foliage scattered through open forest.

South-Eastern Australian coast and interior; mountain ranges and table lands; widespread.

(1) EUCALYPTUS MICROCORYS.
Tallow Wood.

Among the Eucalypt timbers only second to Iron-bark. A first-rate timber tree and quick growing, but only well suited to the lower, damper districts, say Barberton and Swaziland. By some it is placed at the head of all the Eucalypts in economic value.

Southern Queensland and north coast forests of New South Wales.

(2) EUCALYPTUS MICROTHECA.
Microtheca Gum.

A small tree with very hard red timber. Exact durability not established.

Interior, Queensland.

(2) EUCALYPTUS ODORATA.
Odorata Gum.

A medium sized tree with a box-like roughish bark, thin slender leaves, and open foliage; does well in the middle districts of Natal and should be tried in the Transvaal. Timber durable, but liable to be small and crooked.

South and South-east Australia.

(1) *EUCALYPTUS PANICULATA.*
Paniculata Iron Bark.

I saw various trees in Natal and a few in the Transvaal, particularly at Johannesburg. Near Maritzburg it grew 50 feet in 16 years.

On the Natal Coast shows a good height growth, about equal to E. rostrata, but only half the diameter growth of E. rostrata. At Athole, New Scotland, (4,500 feet elevation and 40 inches rainfall) were two healthy trees, about 14 inches diameter and 40 feet high. Professor Maiden ranks this tree as the first of the Iron-barks, thus placing it at the head of all the Eucalypts. It is confined entirely to the coast districts in Australia and is thus the least well-suited of the Iron-barks for the Transvaal.

East Australia.

(*1) EUCALYPTUS PILULARIS.
Black-butt or Flintwood.

The fastest growing Eucalypt at Tokai. Timber durable, but it requires abundant moisture and is tender to frost. At 16 years it grew to a tree of enormous size at Wilkinson, near Maritzburg, Natal. It grew 60 feet in 5 years at Tokai and the same height in ten years in the middle districts of Natal. A very useful tree, particularly in the better watered lower districts of the Transvaal, say Barberton and Swaziland. In Queensland it is generally a mountain tree (Bailey).

Victoria to Queensland.

(1) EUCALYPTUS PLANCHONIANA.
Planchon's Gum.

A fine tree, yielding good timber, suited to the low country only.

Queensland.

(1) EUCALYPTUS POLYANTHEMOS.
Den.

Suited to the driest districts of the Transvaal, where it may be planted along with the Iron-barks. This is the only Eucalypt that does really well in Mr. S. Marks' fine timber plantations at Vereeniging. Maiden classes this amongst the Boxes, but the bark, instead of being fine and stringy is smoothish, like E. tereticornis timber of a deep red colour, and, according to Professor Maiden, one of the most durable in Australia. Usually, however, it is slow-growing and not a large tree. It is one of the best Eucalypts for the Southern Transvaal and Orangia.

New South Wales interior.

(2) EUCALYPTUS POPULIFOLIA.
Populifolia Gum.

A useful medium-sized Gum, medium fast-growing and timber of medium value. Scarcely differs from E. polyanthemos in appearance.

Queensland. On poor soil, both inland and coast.

(2) EUCALYPTUS RAVERETIANA.
Thozet's Box.

A large tree, with a hard but useful indoor timber. Worth trial at Barberton and the Low Country in damp forest valleys. It is one of the giant Eucalypts, reaching a height of 300 feet.

Queensland.

(*1) *EUCALYPTUS RESINIFERA.*
Mahogany Gum or Fosest Mahogany.

A timber very like Jarrah and pronounced by Professor Maiden quite as good. The best Eucalypt in the fine plantations at Kenilworth, Kimberley, is *E. resinifera.* Seed from these trees can be had on application to the Superintendent. Generally, however, *E. resinifera* is a coast tree. The best Eucalypt in the Modderfontein Estate near Johannesburg.

South-east Australia. Coastal forests of New South Wales, mostly north of Sydney.

(2) *EUCALYPTUS ROBUSTA.*
Robusta Gum.

Is frequently met with, planted in the Transvaal, Natal and Cape Colony. In the south-west of Cape Colony it produces an inferior, soft, spongy timber that rots more rapiddly than Blue-gum, and is not liked for firewood. On the eastern side of South Africa it is better adapted to the climate, and has been largely planted on the Natal coast, where, indeed, it might be expected to be at its best. Even there, however, it has the same faults as elsewhere, growing rapidly at first, then seeding profusely and going off. The best grown trees I have seen in the Transvaal were in Pretoria, where it may, perhaps, be worth planting as a shade tree.

East Australia.

(1) *EUCALYPTUS ROSTRATA.*
Rostrata Red Gum.

According to Bailey this well-known timber is not so durable in Queensland as further south, where it has a well established reputation. It and the closely allied E. tereticornis are the Gums most commonly met with in the Transvaal, after E. globulus. Near Maritzburg, Natal, I saw trees up to 120 feet in height.

Interior of Australia, rare near the coast.

(1) *EUCALYPTUS SALIGNA.*
Saligna Gum (Blue-Gum in New South Wales).

There are many fine specimens of E. saligna, both in Natal and in the Transvaal. It is a lofty, straight, quick-growing tree of the first importance. It thrives best at lower elevations and a good rainfall. There are some good trees of this species near Salisbury, Rhodesia.

East Australia. Forests of New South Wales, North of Sydney, on rich damp land or flats.

(1) EUCALYPTUS SALMONOPHLOIA.
Salmon-bark Gum.

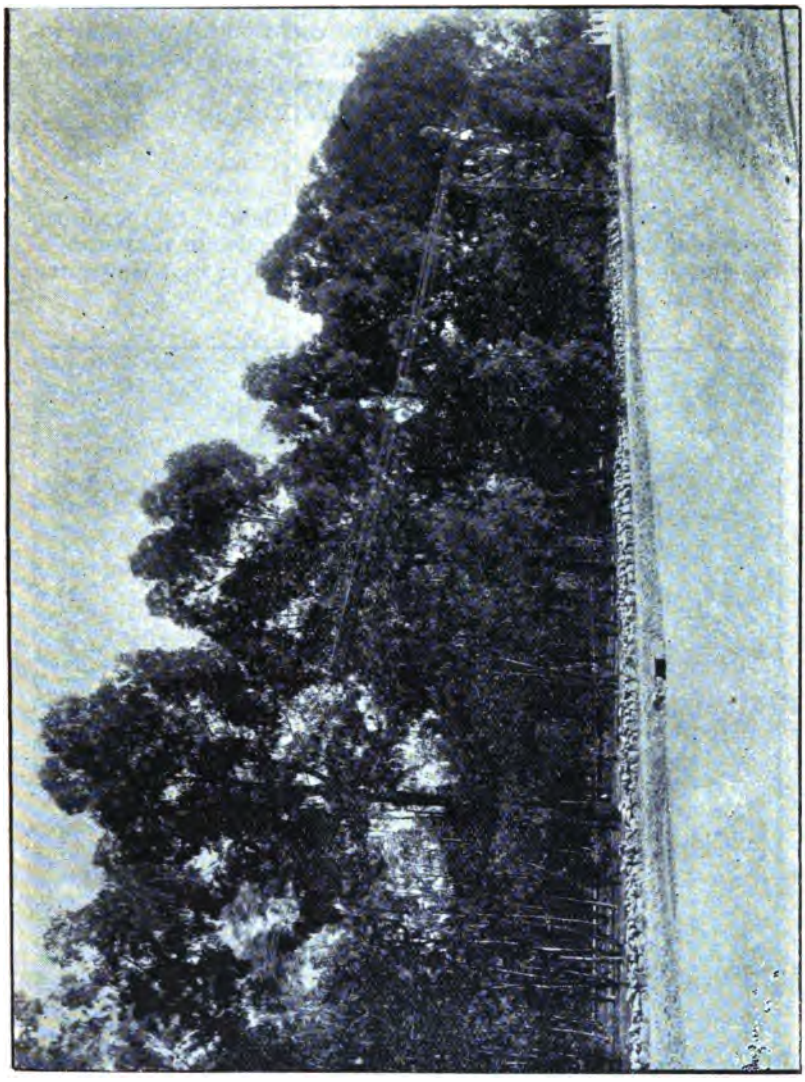
This tree has wonderful drought resisting properties, and though the little rain it gets in West Australia falls in winter, it grows in a country with so little rain that it is practically dependent on sub-soil moisture. It is, therefore, worth trying in the drier districts of the Transvaal. It grows as an upright, well-formed, freshly coloured green tree on the Coolgardie gold fields, down to a rainfall of only 5 inches.

Interior, West Australia.

(1) *EUCALYPTUS SIDEROPHLOIA.*
Broad-leaved Iron-bark Tree.

A first-rate timber; like all the Iron-barks, very durable in the ground. It has, as yet, been little planted in the Transvaal. I only know of a few trees in Johannesburg and a doubtful tree at Athole, New Scotland. It is somewhat tender to drought and frost. Shows a good, straight growth in the middle districts of Natal.

East Australia.



A ROW OF *Eucalyptus sideroxylon* (Ironbark Trees), Pretoria.

(* 1) *EUCALYPTUS SIDEROXYLON.*

Sideroxylon Iron-bark.

This is one of the most valuable and useful gums for the Transvaal. Being a native of the southern plateau country of Australia, it is able to stand frost and drought. There are several well-grown groups of this tree in Pretoria and Johannesburg, where it is seen as a well-shaped tree of medium size ; its rough, ropey bark very characteristic, and producing abundance of small clustered bell-like cones. It is the small-coned variety which has been planted in the Transvaal. As an Iron-bark, the timber of this tree is of the first importance in point of durability and strength. Though not so fast-growing or so well-shaped as the Iron-bark, E. paniculata, it is more

drought-resistant. It extends further inland than any other Iron-bark, and it occupies the dry, cold south-west plateau country of East Australia. It is the Iron-bark best adapted for the cold dry districts of the Transvaal.

Plateau country of East Australia.

(2) EUCALYPTUS STUARTIANA.

Stuart's Gum.

Timber held to be durable in Queensland. In the more southern colonies it is looked on as a second-rate timber. A medium-sized tree. Planted in the Transvaal as frost resistant.

East Australia.

Eucalyptus tereticornis, Irene.

(*1) *EUCALYPTUS TERETICORNIS.*

Tereticornis Gum.

The commonest tree in the Transvaal after Blue-gum. It grows nearly as fast as Blue-gum, but has, when mature, a far superior timber. It scarcely differs from *E. rostrata*;

but is generally a straighter, better-grown tree, to be preferred to *E. rostrata.* There are several varieties of it. See above, under *E. rostrata.* Many experts select it in preference to *E. rostrata,* when both are available.

Queensland. Coastal country, usually in dry open forests.

(2) EUCALYPTUS TERMINALIS.
Blood Wood.

A dry country form of the ordinary Bloodwood, E. corymbosa. Worth trial in the drier western districts of the Transvaal.

Queensland, in interior.

(2) EUCALYPTUS TESSELARIS.
Moreton Bay Ash.

For trial planting in the hottest low districts. Timber not durable, but tough.

Northern Australia, coast and interior.

(1) *EUCALYPTUS VIMINALIS.*
Viminalis Gum.

E. viminalis has been extensively planted in every part of the Transvaal. It is comparable to Blue-gum in the inferior quality of its timber, but superior to Blue-gum in its resistance to frost. Generally, too, it makes straighter, cleaner stems than Blue-gum. The finest Viminalis Gums I know in the Transvaal, are on the farm " Marydale " in the New Scotland District. It grows with great vigour in Natal, often showing a good re-growth of self-sown seedlings.

South-east Australia.

(2) EUGENIA EUCALYPTOIDES.
Mini.

This is a very handsome tree, with dense, dark-green, crinkled, drooping leaves. It is slow-growing and only suited to the warmer parts of the Transvaal. It can be obtained from the Maritzburg Botanical Gardens.

South America.

(2) EUGENIA NHANICA.
Nhanica Tree.

Berry a table fruit. Would probably succeed on the Woodbush Range.

South Brazil.

(2) EUGENIA PYRIFORMIS.
Uvalho do Campo.

Fruit eatable. Would probably succeed on the Woodbush Range.

South Brazil.

(2) FICUS CUNNINGHAMI.
Cunningham's Fig.

A large shade tree, probably useful for planting on rocky ground up to about the elevation of Pretoria—might be tried at Brynterion.

Queensland, widespread.

(2) FICUS INFECTORIA.
Fig.
Quick-growing shade tree. Should be tried with *F. cunninghami*. It should be the hardier of the two.
Western Himalayas, to 5,000 feet.

(2) *FICUS SP.*
Native Figs.
There are several species of native Fig growing in the open scrub-like forests, that are well worthy of cultivation for ornamental purposes. They are very hardy, growing often in the rockiest and most unfavourable situations, and, though of no value for timber, make handsome shade trees. Most of them are more or less leafless in winter. Similar native Fig trees are largely used for roadside planting in India.
Indigenous in the open scrub-like forests of the Transvaal.

(2) *FICUS MACROPHYLLA.*
Moreton Bay Fig Tree.
In appearance like *Ficus elastica*, the India-rubber tree. Bailey says it is, perhaps, the largest tree in Queensland. Tender to frost in the Transvaal. A fine shade tree.
Queensland.

(2) FICUS WATKINSIANA.
Watkins Fig.
Like *F. macrophylla*, but stands cold better.
Queensland, on mountains .

(1) FLINDERSIA AUSTRALIS.
Crows Ash.
One of the chief timbers of Queensland. A leaf-shedder; wood yellow, very strong and durable. Probably tender to drought and frost in the Transvaal. Try it first in the lower damper districts, such as Swaziland.
Queensland.

(2) FLINDERSIA BENNETTIANA.
New South Wales Teak.
A large tree, with wood of some value. Probably tender to frost and drought in the Transvaal.
New South Wales.

(2) FLINDERSIA BOURJOTIANA.
Flindersia.
A noble tree, with deep green foliage (Bailey). Timber mediocre. Barberton, Swaziland and Low Country.
Queensland.

(2) FLINDERSIA OXLEYANA.
Queensland Yellow-Wood.
Wood of a bright yellow colour, elastic, and not readily attacked by white ants. Worth trial in the Transvaal, in the lower damper districts.
Queensland.

(1) *FRAXINUS EXCELSIOR.*

The Common Ash.

I have seen no good specimens of the European Ash in the Transvaal, where it appears to suffer from the dry spring, except a few trees in the Pretoria Park, where they would get water in Spring. The Himalayan tree remains to be tried. This is a large handsome tree in the North-west Himalayas, 50-60 feet high, with a straight tall trunk (Brandis). The timber does not differ from the well-known European Ash. The Himalayan Ash should be well suited to the climate of the North-east forest country, and it is very desirable to grow Ash timber in South Africa.

West Himalayas, 4-6,000 feet.

(2) FRAXINUS FLORIBUNDA.

Floribunda Ash.

A fine tree, closely allied to *Fraxinus ornus* of Southern Europe. Suited to planting in the coldest part of the wet mountain ranges.

Afghanistan, less common in the Himalayas, 4,000 to 11,000 feet.

(1) FRAXINUS TEXENSIS.

Texan Ash.

Some writers regard this as only a variety of *F. americana*, which has the best timber of all the American Ashes. The timber of *F. texensis* is harder and smaller than the finer northern tree, *F. americana.*

Texas, in the drier country.

(1) FRAXINUS VELUTINA (Torr.).

Doing well as a planted tree in Cyprus. Planted along irrigation channels in Northern Mexico on account of the abundant shade afforded by it. There is a variety, "*Coriacea*" growing on dry ground, with timber often hollow (Sargent).

Western Texas, New Mexico and Arizona, on mountains or near streams.

(1) FRAXINUS BERLANDIERIANA (A de C) (Sudworth).

Green Ash.

Should be well adapted to the Transvaal. A tree up to 60 feet high. It should be tried along with the preceding, in the north-east forest country and elsewhere near streams or on deep soil.

Mexico and Texas, but Sudworth thinks originally indigenous in South Mexico.

(2) FUSANUS ACUMINATUS.

Kwondong.

This is a graceful, small ornamental tree, which, being so widespread in Australia, will probably succeed in the Transvaal, where frosts are not very severe. It has pretty, drooping foliage, with large red fruits, used for jam-making in Australia. The wood is fragrant and is stated to have been exported to some extent as Sandal, from West Australia.

Throughout the Australian Continent.

(2) GEIJERA MUELLERI.

Mueller's Geijera.

Medium sized tree, with fragrant foliage and a beautiful, dark clouded heartwood (Bailey). Eastern Transvaal, 3,000 feet, downwards.

Queensland.

(2) GINKGO BILOBA.

Maidenhair Tree.

A poor tree in South Africa: a fine tree in Japan, where it is planted near temples. Long thought to have become extinct as a wild tree but Mrs. Bishop, the distinguished traveller, writes that she met with several fine specimens of the Gingko in the magnificent forests which surround the sources of the Great Gold River and the smaller Min, in Western China, and also in the forests of Central Yesso, Japan. (Index Floræ sinensis.—Dr. M. T. Masters.)

(2) *GLEDITSCHIA TRIACANTHOS.*

Honey Locust.

I saw a few specimens in Natal and the Transvaal. In Mr. Hume's arboretum, Johannesburg, it grew quickly to a large tree. In America cultivated for hedge purposes and shade. Timber unfortunately very hard but durable as a post. The variety "*inermis*" is nearly thornless. It may be worth cultivating in the drier districts of the Transvaal. This is neither a large nor a well-grown tree, but it is a leaf-shedder and will stand the drought and frost of the drier parts of the Transvaal. A tree 30 years old, in the Maritzburg Botanical Gardens measured 12 inches diameter and 50 feet height.

North America, south to Texas.

(2) GLYPTOSTROBUS HETEROPHYLLUS (Taxodium sinensis).

Chinese Water Pine.

This curious tree, with its thread-like branches and closely pressed fine leaves has long been cultivated in the gardens of Europe and the United States. Masters, in the Kew list of Conifers and elsewhere, regards it as a separate species coming from China, and this is the view of C. Hansen (Conifer conference) and most botanists. But Sargent, in his Silva of North America, states that it is merely a variety of *Taxodium distichum*, not uncommon in the forests of Florida and Carolina.

South China, its exact distribution not known. Planted along the edge of rice-fields near Canton.

(2) GMELINA ARBOREA.

Kuli.

A large, leaf-shedding tree, with timber, light, durable and sometimes replacing Teak. Also an ornamental tree, worthy of cultivation in the warmer, wetter parts of the Transvaal, rainfall not less than 40 inches.

Tropical India, up to 5,000 feet.

(2) GMELINA LEICHHARDTII.

Queensland Beech.

A tall tree, with good timber that is durable outdoors and resists white ants. Eastern Transvaal below 4,000 feet.

South Queensland.

(1) *GREVILLEA ROBUSTA.*

Silky Oak.

This tree, with its handsome, fern-like foliage, has been largely planted in the Transvaal, but nowhere with complete success. Even in Pretoria, with its close summer heat and abundance of water, it is evident that the tree requires more heat and more moisture to grow well. The Pretoria trees bear abundance of good seed. Killed by frost in the colder parts of the Transvaal. The best trees I have seen in South Africa were in the Maritzburg Botanical Gardens. Wood soft, useful for staves and indoor work generally.

Queensland.

(2) GREVILLEA STRIATA.

Beefwood.

A small tree, with mediocre timber. Try in the lower western districts.

Queensland interior.

(2) GUAJACUM OFFICINALE ?

Palo-santo.

A good timber tree for the low country; or perhaps, the Barberton District. If this tree be Guajacum officinale, it is the same as the Lignum Vitæ of commerce.

Gran Chaco, South America.

(2) HAGENIA ABYSSINICA.

Hagenia.

A tall ornamental tree, worth trying if the seed can be got.

Abyssinia, 3,000 to 8,000 feet.

(1) *HAKEA LAURINA.*

Laurel Hakea.

Probably the best hedge plant for the Transvaal: can be seen growing very well in Mr. Hume's arboretum, Johannesburg and in the Saxonwald plantation. It forms a dense handsome hedge.

East Australia.

(2) HANCORNIA SPECIOSA.

Hancornia Rubber Tree.

An extra tropical rubber tree. Might be tried in the lower districts.

Brazil and Argentine.

(2) HARPULLIA HILLII.

Hill's Harpullia.

A moderate sized tree with ornamental wood. Eastern Transvaal, below 4,000 feet.

East Australia.

(2) HARPULLIA PENDULA.

Tulip Wood.

A fine tree, with a beautifully figured furniture wood. Might be tried at Barberton and the wetter lower districts.

New South Wales.

(2) HELICIA PRÆALTA.

Long-leaved Nut Tree.

A prettily marked, red-coloured wood, durable. (Bailey) Might be tried in the lower mountainous country of the Eastern Transvaal.

Queensland, usually in the mountains.

(2) HYMENÆA COURBARIL.

Courbaril. Algorobo in Mexico.

One of the noblest of timber trees. May be tried in the wetter parts of Barberton, and the low eastern districts. Timber hard and durable. Get seed from Mexico.

Tropics, and warm, extra-tropical South America.

(2) ILEX AQUIFOLIUM.

Holly.

Worth planting for home associations, but only likely to succeed on the Woodbush Range, or a similar locality. It grows well in a damp, sheltered locality near Maritzburg, Natal (Wilkinsons). Growing well at Athole, Ermelo District.

Europe.

(2) ILEX PARAGUENSIS.

The Mate Tea Plant.

Yields the valuable Mate Tea. Suited to the lower districts of the Transvaal.

South Brazil.

(1) *JACARANDA MIMOSÆFOLIA.*

Jacaranda.

Bears gorgeous blue flowers and yields the Palixander wood of Brazil. There are a few specimens in the Pretoria gardens, where, however, it is tender to frost. Poor growth in Botanical Gardens, Durban. Does well at Grahamstown, Cape Colony. This tree is planted in avenues in Madeira, and in summer, when in blossom, looks as if festooned with Wistaria blossoms. A valuable tree for the lower wetter districts.

Brazil.

(1) JUGLANS NIGRA.

Black Walnut.

A good tree, 12 inches x 45 feet, in Durban Botanical Gardens. Smaller trees in the Transvaal.

North America and Mexico.

(1) *JUGLANS REGIA.*

Common Walnut Tree.

Himalayan seed should be tried. There are many young trees raised from European seed in Johannesburg, but older trees have died off in other parts of the Transvaal. This tree must have lime in the soil. Did fairly at Athole, New Scotland. In the Himalayas, Brandis states that the Walnut occurs as a true forest tree. The nuts of this tree are thick-shelled and useless for eating.

Extends south as far as the mountains of Burmah.

(2) JUNIPERUS ÆGÆA.

Ægæan Pencil Cedar.

Worth trying in the Transvaal. But it is very slow-growing and not well suited to the Transvaal climate.

Greece.

(1) *JUNIPERUS BERMUDIANA.*

Pencil Cedar.

A first-class timber tree, yielding the Cedar of lead pencils. Contrary to what one would expect, I have seen healthy trees all over the Transvaal, but the tree is only climatically well suited to the damper warmer districts. I saw one or two healthy young trees at Zaarkuil, Woodbush, and there are healthy trees, 30 feet high at Irene.

Bermuda and tropical mountains, to 6,000 feet.

(1) JUNIPERUS BREVIFOLIA.

Azores Cedar.

One of the tallest Junipers and the most valuable of Cedars. It may do well in the north-eastern forest country. It requires abundant moisture. Veitch regards this as only a geographical variety of *J. oxycedrus.* The wood is so durable, even in the trying, damp climate of the Azores, that old timber is dug up sound, the buried remains of former forests. (Veitch).

Azores, up to 5,000 feet.

(1) JUNIPERUS CEDRUS.

Canary Island Cedar.

A very desirable introduction for the Transvaal, but hitherto all attempts to procure its seed have failed. Veitch regards this also as only a geographical variety of *J. oxycedrus.* He adds that a plant in the temperate house at Kew cannot be distinguished from *J. oxycedrus.*

Higher mountains of Canary Islands.

(1) JUNIPERUS CHINENSIS.

Chinese Jupiter.

Though slow-growing, this becomes a tree of large size and, having so wide a range, it should prove a valuable introduction for the Transvaal. It is grown as a small ornamental tree in England.

Thibet, China, and Japan on mountains.

(2) JUNIPERUS DRUPACEA.

Plum Juniper.

I only know one doubtful specimen in the Transvaal, where this tree's rainy season is reversed.

Asia Minor.

(2) JUNIPERUS FLACCIDA.

Flaccida Juniper.

A very ornamental, small tree, and valuable if it grows to a large tree in the Transvaal. Flourishes in Southern Europe.

Mexico, 5,000 to 8,000 feet.

(2) JUNIPERUS FŒTIDISSIMA.

Grecian Cedar.

Allied to *J. excelsa*, with the same valuable Cedar wood. This is, however, a winter rainfall tree.

Mountains of Greece.

(1) JUNIPERUS MACROPODA (*J. excelsa* of Brandis).

Himilayan Pencil Cedar.

Is cultivated in India at much lower elevations. Wood harder than the American Pencil Cedar. Trees up to 90 feet high in Taurus mountains. A tree of slow growth, but well suited to high, dry, bleak localities in the Transvaal.

Asia Minor, 2,000 to 6,000 feet, and arid Himalayas, above 5,000 feet.

(2) JUNIPERUS MEXICANA.

Mexican Juniper.

It is doubtful if this tree is worth growing, except as an ornamental tree, in the Transvaal. It is usually a small, slow-growing tree at Alpine elevations in Mexico.

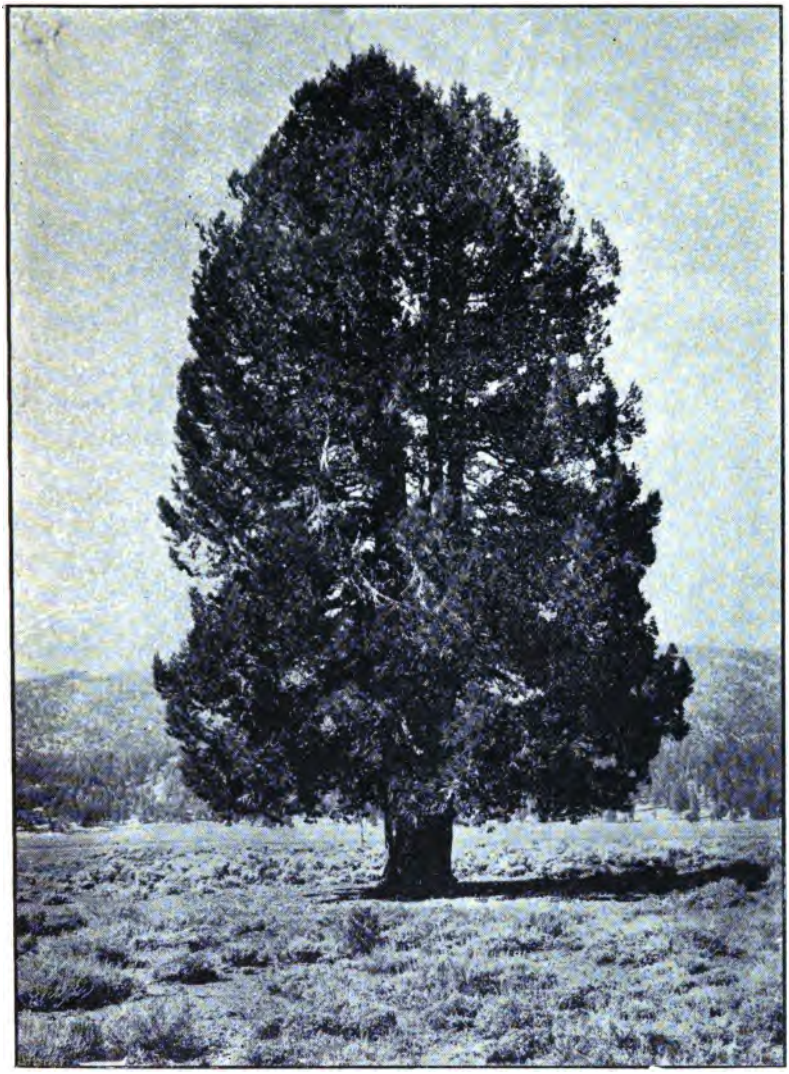
Mexico, 6,000 to 10,000 feet.

(1) JUNIPERUS MONOSPERMA.

Monosperma Juniper.

Allied to *J. occidentalis*, but growing at lower elevations. Well suited to the Transvaal. Probably slow-growing.

Texas and Mexico.



Juniperus occidentalis, California.

(1) JUNIPERUS OCCIDENTALIS.

Occidentalis Juniper.

Stated to form pure forests of well-grown trees in Mexico. It is closely allied to and difficult to distinguish from *J. californica.*

Mountains of California and Northern Mexico.

(2) JUNIPERUS OXYCEDRUS.

Oxycedrus Juniper.

Worth trial in the Transvaal.

In Madeira, from the rocky coast to mountain tops.

(1 *) JUNIPERUS PACHYPHLOIA.

Thick Bark Juniper.

A beautiful tree with a massive trunk, a most desirable introduction. The prevailing and largest Juniper of the mountains of Western Texas (Sargent). This valuable tree should be tried all over the Transvaal, though it will probably do best in the drier, western districts, say at Lichtenburg. Slow-growing. Apart from the Deodar (which can hardly be regarded as a true Cedar) this tree, *J. virginiana*, and *J. cedrus* are probably the best of the true Cedars for the Transvaal.

Dry mountain slopes in Texas and Mexico, 4,000 to 6,000 feet.

(1) JUNIPERUS PROCERA.

Procera Cedar.

It may be looked on as a more tropical form of *J. macropoda*. Trees up to 100 feet in Abyssinia. This Juniper should be tried if seed can be procured. It is one of those best suited to the Northern Transvaal. Botanical specimens cannot be distinguished from *J. excelsa*, of which it may perhaps be regarded as a geographical variety.

Abyssinia and North East Africa.

(1) JUNIPERUS SPHÆRICA.

Sphærica Juniper.

Little is known about this species except that it came from China. It can be procured from European botanical gardens. It should certainly be tried in the Transvaal.

China.

(1) JUNIPERUS TAXIFOLIA.

Yew-leaved Juniper.

Little is known about this species except that it came from China. It can be procured from European botanical gardens. It also should be tried in the Transvaal.

China.

(2) JUNIPERUS UTAHENSIS.

Utah Juniper.

A small, very slow-growing tree. It may be worth introducing on some of the highest mountain tops of the dry Western Transvaal.

Mountains of Utah.

Juniperus virginiana (Red Cedar), Pretoria.

(1 *) *JUNIPERUS VIRGINIANA.*

Ordinary Pencil Cedar.

This in the Florida tree is the well known Cedar of commerce. The ordinary American tree extends from Canada to Florida. For the Transvaal, seed should be procured from Texas. By some botanists the dry country form, suited to the Transvaal, is known as *J. scopulorum.* This tree is very hardy, and the wood of value, but it is slow-growing. It has been planted throughout the Transvaal, and, so far as one can judge from young trees, with perfect success. There are fine healthy young trees in the Pretoria Park and at Irene. It resists the most severe frosts, and can go entirely without rain for

8 or 10 months. In a cold climate it turns almost as red as the Copper Beech in winter. It grew 14 feet in 5 years in Mr. Hume's arboretum at Johannesburg. This is a good growth for a Juniper.

United States of America.

(2) *LAGERSTRŒMIA FLOS-REGINA*

Pride of Pretoria.

Pretoria in January is ablaze with its gorgeous pink flowers. Specimen trees may be seen even in Cape gardens. It will only make a timber tree in the wettest and warmest parts of the Transvaal. One of the chief timber trees in the wetter parts of the tropical forests of India and Burmah.

Tropical India, to 5,000 feet elevation.

(2) LAGUNARIA PATERSONI.

A handsome tree with large purple flowers. Grows with care out of doors at Cape Town and in Natal. Only suited to the lower districts of the Transvaal.

North Queensland (Bailey) and Norfolk Isiand.

(2) LARIX GRIFFITHII.

Himalayan Larch.

May be tried on the coldest, wettest mountains of the Transvaal. It is not likely to be of much service in the Transvaal, though it grows in the Himalayas where the common European Larch fails. Growth slow. Timber good and durable.

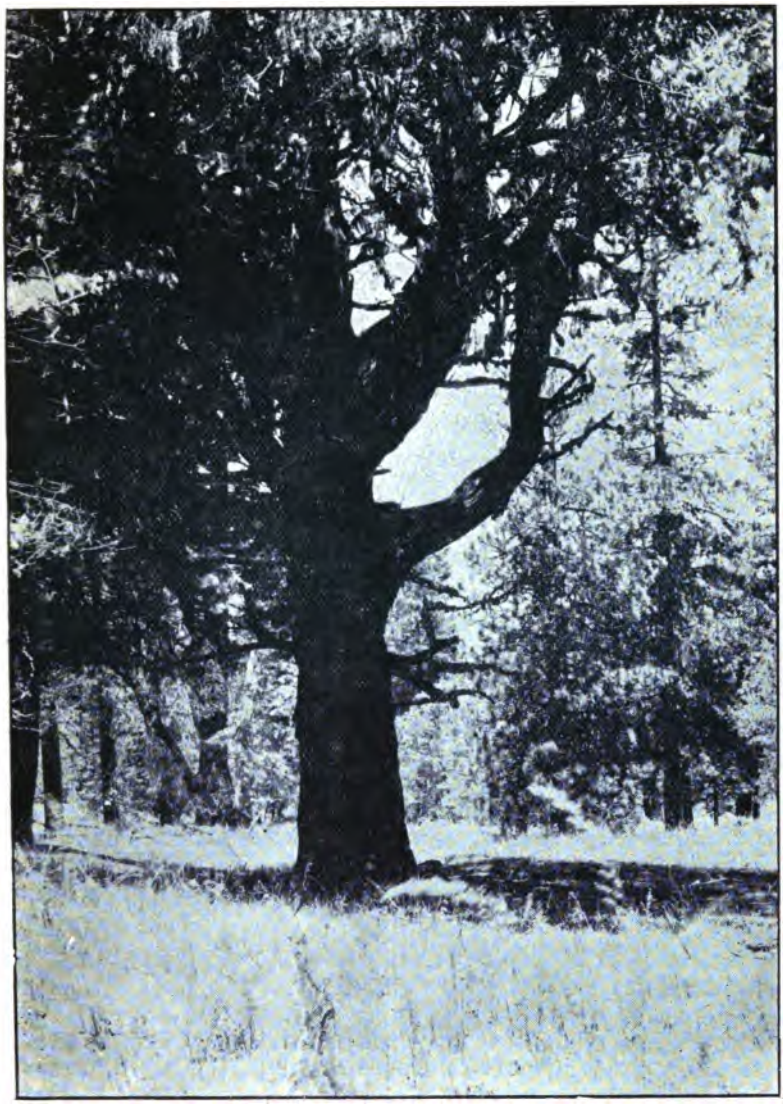
Eastern Himalayas, 8,000 to 12,000 feet.

(2) LARIX LEPTOLEPIS.

Japanese Larch.

This is the Japanese Larch that is being extensively cultivated in Europe to replace the common Larch, which, grown as an exotic in the low country of Northern Europe, has become liable to disease. The Japanese Larch may be tried on suitable, cold, wet mountain sites in the Transvaal. Its timber has the same good qualities as the European Larch.

Central mountains of Japan, 5,000 to 7,000 feet, latitude 35° to latitude 38°. Cultivated at lower elevations (Sargent).



Libocedrus decurrens (Incense Cedar), California.

(2) LIBOCEDRUS DECURRENS.

Incense Cedar.

In the mountains of lower California this tree gets a climate not altogether unlike that of mountains in the middle districts of the Transvaal, where this valuable Cedar is certainly worth trying. The wet-country tree from Oregon and northern California is commonly seen as a handsome tree on British lawns.

Californian mountains, 3,000 to 8,000 feet.

(1) LIBOCEDRUS MACROLEPIS.
Chinese Cedar;
This is a first-rate timber tree, and should be tried in various parts of the Transvaal wherever there is a good rainfall. The most valuable wood in Formosa (Masters).
China, latitude 23° to 25°. Yun-nan.

(2) LIGUSTRUM JAPONICUM.
Japanese Privet.
Frost-resistant, and a first-rate hedge-plant in the damper districts.
Japan.

(2) LIQUIDAMBAR STYRACIFLUA.
Liquidambar Tree.
An important timber tree with a wood like walnut in appearance, but seasoning badly. Seems well suited to the Transvaal.
Central and Southern Mexico.

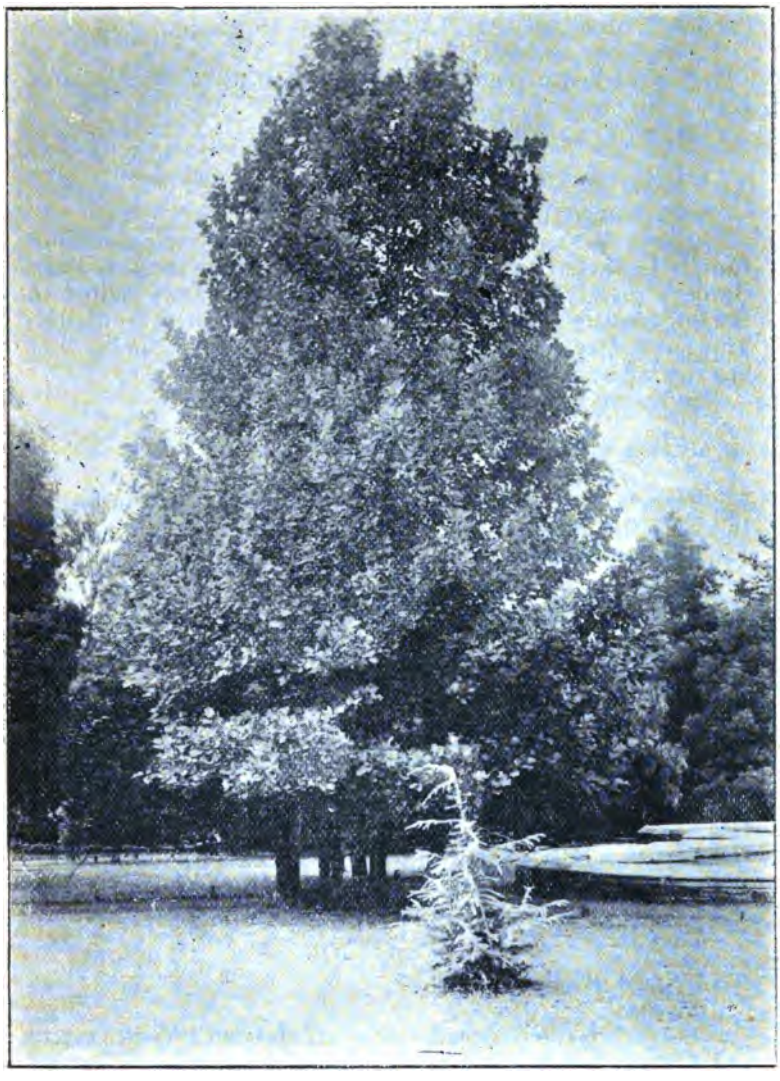
(1) *LIRIODENDRON TULIPIFERA.* (*See Plate, page* 89.)
The Tulip Tree.
This fine shade tree can be seen growing well at Irene, Pretoria, Johannesburg, and other parts of the Transvaal. It is well suited to the wetter, colder districts. One of the best trees in Mr. Hume's arboretum at Johannesburg, where it grew 14 feet in 5 years.
North America.

(1) LOXOPTERYGIUM LORENTZII.
Quebracho Colorado.
Very valuable, but slow-growing. Its timber is indestructible and full of tannin. The wood and tan extract made from it is largely exported from the Argentine. A first-rate timber for sleepers, but only well suited to Barberton and the lower districts.
Argentine.

(2) LYSICARPUS TERNIFOLIUS.
Tom Russel's Mahogany.
An erect, pine-like tree, much esteemed in Australia. It should be tried at lower elevations in the north-eastern forest country of the Transvaal.
Queensland mountains.

(2) MACADAMIA TERNIFOLIA.
The Nut Tree.
Test-planting in the warmer districts. Furnishes a useful nut.
Eastern Australia.

(2) MACHÆRIUM ALLEMAI.
Machaerium.
A useful timber tree, but only likely to succeed in the north-eastern forest country of tde Transvaal.
South Brazil.



Liriodendron tulipifera (Tulip Tree);
Cedrus deodara (Young Deodar) in foreground; Pretoria.

(2) MACHÆRIUM INCORRUPTIBILE.
Machaerium.
Lasts well in the ground. May be tried in the north-eastern forest country of the Transvaal.
South Brazil.

(2) MACHÆRIUM LEGALE.
Machaerium.
Lasts well in the ground. May be tried in the north-eastern forest country of the Transvaal.
South Brazil.

(2) MACLURA AURANTIACA.
The Osage Orange.
A good hedge plant. The tree furnishes elastic, durable poles. Stands frost well.
Texas.

(2) MANGIFERA INDICA.
The Mango.
Comes to perfection at Bangalore, 3,000 feet, Southern India. Grafted trees should be obtained from the Làl Bàgh Gardens there. The pearl of tropical fruits. Only suited to the low country. Even on the Natal coast the fruit is inferior. The forest tree has worthless fruit, but a useful timber. It has run wild and formed useful forest in Jamaica.
India, up to 4,000 feet, or even 5,000 feet

(2) MELALEUCA LEUCADENDRON
The Cajaput Tree.
Timber very durable, but tree generally slow-growing. It yields the cajaput oil. Plant in swampy ground.
Eastern Australia.

(2) MELALEUCA LINARIFOLIA.
Tea Tree.
Useful for swampy ground, especially if brackish. Timber durable.
Eastern Australia.

(2) *MELALEUCA STYPHELIOIDES.*
Tea Tree.
This is one of the largest of the Tea trees and the one that best shows the remarkable papery bark. The wood is very durable, but it is excessively hard, and the tree is so slow-growing that it has little practical timber-producing value. I saw well-grown trees at Athole, in the New Scotland District.
Eastern Australia.

(1) *MELIA AZEDERACH.*
Syringa.
Largely planted already in the Transvaal; does best in the lower districts: one of the hardiest of trees. Timber soft and of a red colour. There are numerous varieties or sub-species. There is a good and a bad variety under cultivation now in Salisbury, Rhodesia.
Persia, and cultivated throughout the world.

(1) *MELIA COMPOSITA.*
Australian Syringa or White Cedar.
A large, leaf-shedding tree, larger than the ordinary Syringa, with timber of a light red colour, soft and easy to work. Flowers fragrant. Brandis describes the Indian tree as having white flowers, Bailey the Australian tree as having blue flowers. As a young tree in the nursery, raised from Australian seed, I cannot distinguish this tree from the ordinary Syringa.
Queensland, New South Wales, and India.

(1) *MELIA INDICA.*

Neem.

An evergreen, medium-sized tree, allied to the Syringa, but less hardy against frost and drought. A useful, fairly durable timber, so bitter that white ants will not touch it. Largely planted in Northern India. Suitable for Barberton and the lower districts.

Himalayas, to 5,000 feet.

(2) *MESPILUS GERMANICA.*

Medlar.

Though common in the forests of France, this is really a fruit tree. It flourishes in the fertile eastern Transvaal. I saw two trees doing well at Athole, on the Swazie border.

Europe.

(1) MICHELIA CHAMPACA.

Champaka.

A tall, beautiful tree, with scented, yellow flowers and a first-class timber, strong, durable, and not too hard, 37 lbs. the c. ft. Timber in appearance similar to Camphor, and more durable than Camphor in the ground. Wood intensely bitter (Gamble). The finest of the trees on Nundidroog, 4,800 feet elevation (Mysore), where the climate closely resembles that of the lower, damper districts of the Transvaal.

Western Himalayas, to 5,500 feet, and Southern India on mountains.

(2) *MORUS ALBA.*

White Mulberry.

Often planted, as at Pietersburg, in hedges. Perhaps the best Silk-worm Mulberry. There is an allied variety growing to a large shade tree, but I have not seen this in South Africa.

Northern India, and up to 11,000 feet on the Himalayas.

(1) MORUS CELTIDIFOLIA.

Mexican Mulberry.

A good timber tree, well worthy of cultivation in the Transvaal.

Mexico, up to 8,000 feet.

(2) MORUS INDICA.

Silk-worm Mulberry.

This is the tree commonly cultivated in Bengal to feed silk-worms. It is rapid-growing and hardy, though often small. It has sprung up self-sown, and ousted the Sissu from Changa-Manga and other plantations in India. Suitable for Barberton and the lower districts.

North-Western Himalayas, to 4,000 feet.

(2) MORUS MICROPHYLLA.

A Mulberry.

A small Mulberry of North Mexico. worth trial in the Transvaal.

Mexico.

(1) *MORUS NIGRA.*

Black Mulberry.

This is the common fruit Mulberry. Cuttings from the Persian tree may succeed better than those of European stock. There are various varieties with improved fruit in cultivation. Grows fairly at the Cape in rich, moist, soil but better in the Karoo under irrigation. It grows well and yields fruit well in Mr. Hume's arboretum at Johannesbrug. Timber good. It may be worth planting for timber in the north-eastern forest country.

Europe and Asia.

(1) MORUS RUBRA.

Red Mulberry.

The largest of the Mulberries, and a fine timber tree, with strong, durable timber. It has also good, large fruit. This seems the best Mulberry for the Transvaal.

North Mexico.

(1) MORUS SERRATA.

Serrata Mulberry.

A large tree, with large, soft leaves, yielding a good furniture wood. This fine tree would probably be a distinct gain throughout the Transvaal.

North-Western Himalayas, 4,000 feet to 9,000 feet ; often cultivated.

(2) NEGUNDO ACEROIDES.

Box Elder.

A shade tree up to 70 feet high ; timber inferior. One of the most widely distributed American trees (Sargent). Trial planting only.

Mexico.

(2) ORITES EXCELSA.

Silky Oak.

A tall tree, with mediocre timber. May be tried in the eastern forest districts.

New South Wales.

(2) OWENIA VENOSA.

Tulip Wood.

A large tree, with reddish, hard, durable timber.

Northern and Southern Queensland.

(2) PARKINSONIA ACULEATA.

Jerusalem Thorn.

A thorn hedge plant, cultivated largely in America. Flowers handsome. It succeeds in the lower Transvaal, but is killed by frost in Hanover, Cape Colony.

Mexico, and cultivated throughout the warmer parts of the world.

(2) *PAULOWNIA IMPERIALIS.*

Paulownia.

Ornamental tree, planted in various parts of the Transvaal. Only half hardy in the colder districts. It does fairly at Maritzburg, Natal, but better nearer the coast. I noticed it suffering from drought in spring even at Woodbush village. It grew 15 feet in 13 years at Irene.

Japan.

(*1) PERSEA NANMU.

Chinese Coffin Tree.

A tall, clean-stemmed tree, with ashy-grey bark. Yunan and elsewhere in China. This tree furnishes the soft, scented timber used in the coffins of wealthy Chinese and very high prices are paid for it for this purpose. Used in palaces, and as timber esteemed higher than Teak. £20 has been known to be paid for a plank of highly-scented wood of the best quality. It is an even-grained wood with a peculiar lustre when worked up. It is said to be more valuable than Sandal wood.

China, inland, about latitude 30°.

(2) PERSEA TENERIFFÆ.

Persea.

A fine tree with a mahogany-like timber. May be tried in the north-eastern forest country of the Transvaal. *Persea gratissima* is the Avocado pear.

Canaries, Madeira, and Azores.

(2) *PHŒNIX DACTYLIFERA.*

Date Palm.

Best suited for the driest low country with irrigation. It may be seen in various parts of the Transvaal, but only ripens good fruit in the hottest parts. Has done well in Central Australia.

Arabia, Persia, etc.

(2) *PHYTOLACCA DIOICA.*

Belhambra.

A shade tree, planted all over the Transvaal with, however, little to recommend it.

Argentine.

(2) PICEA ALCOCKIANA.

A Spruce.

Mongolia and Japan. ("Index Floræ sinensis."—Dr. Masters).

(2) PICEA AJANENSIS.

Northern Japanese Spruce.

May possibly be worth trial cultivation on the coldest, wettest mountain tops of the Transvaal. Not, however, likely to succeed except, perhaps, on the Southern Drakensberg.

Yezo and Central Japan, on the mountains to latitude 35°.

(2) PICEA BRACHYTILA.

Yunan. Nearly allied to P. alcockiana. ("Index Floræ sinensis."—Dr. T. Masters).

(2) PICEA LIKIANGENSIS.

Yunan; Likiang at 2,800 feet. ("Index Floræ sinensis." —Dr. Masters).

(2) PICEA MORINDA (better known as Abies smithiana).

Himalayan Spruce.

This is the Himalayan form of the common European Spruce (*Picea excelsa*), which its timber much resembles. It grows as large as the European Spruce, and fairly fast in the Himalayas; very slowly at the Cape. It is associated with Deodar in the Himalayas. Its timber is inferior to Deodar.

Himalayas, 6,000 to 11,000 feet; the best forest at 7,500 to 8,500 feet.

(2) PICEA OBOVATA (var, schrenkiana).

Yunan and Central China. ("Index Floræ sinensis."—Dr. Masters).

(2) PICEA POLITA.

Tiger-tailed Spruce.

Rare in the wild state, but much cultivated as a small tree in Japan. It has done well in New Zealand. Veitch considers this to be the most ancient of the Piceas and in process of dying out. It makes a pretty young tree. C. Hansen puts a low value on *P. polita* as a timber tree.

Warmer and wetter parts of Japan.

PINUS (CEMBRA) ARMANDI.

Yunan and the mountainous portions of Central China. ("Index Floræ sinensis."—Dr. Masters).

(*1) *PINUS AUSTRALIS.*

Long-leaf Pitch-pine.

This is the best of the four Pitch-pines of the Gulf States, United States of America—P. mitis, P. cubensis, and P. taeda being the others. The timber in weight averages rather heavier than Teak. Its value is as well known in South Africa as in America. At the instigation of Michaux it was largely planted in 1830 in Southern France and Italy, but few of these trees now remain. I saw several of the American Pitch-pines in the Transvaal as young trees; but, without cones, it was not possible to identify them. All should be well tried in the forest plantations, but not on dry ground nor in localities west of Johannesburg. Probably the best results will be attained on the Woodbush Range or at Belfast. These Pitch-pines must have moisture more or less throughout the year, and would be sensitive to the dry Transvaal spring.

Northern America, Gulf States, from an elevation of 2,000 feet on the Appalachian Mountains to latitude 32° in Texas.

(* 1) PINUS AYACAHUITE.

White Pine of Mexico.

Should be tried on Volkberg and other mountains of the eastern borders of the Transvaal. It is said to form extensive forests on the mountains in Northern Mexico, and to supply the best timber of the country. It has been long naturalized in England.

Mexico, at higher elevations.

(* 1) PINUS BUNGEANA.

Bunge's Pine.

This is a fine Pine, able to endure the very dry but cold winters of Pekin. It may fail in the Transvaal on account of the comparatively warm winters, or it may grow more rapidly and vigorously than in China, and prove a most valuable introduction. As a summer-rainfall Pine it deserves careful and extended trial in the Transvaal. It has been long grown as a park tree in England. Seed could be procured from Europe or preferably from China; perhaps through Boehmer of Tokio, Japan, or the Superintendent, Botanical Gardens, Hongkong. The French Ambassador at Pekin, in China, furnished the following note regarding *P. bungeana* :—" When it is young, this tree in China has greenish bark coming off in scales like that of the Plane tree. As the trunk of the tree gets older, the bark becomes whiter, looking finally as if whitewashed. One sees huge Bungeana Pines in the Imperial Gardens no doubt of enormous age."—(Bull. Soc. d'Acclim.)

China, near Pekin. Pekin, Nanto, and mountains to northward, North Shensi, on the mountains. (" Index Floræ sinensis."—Dr. T. Masters.)

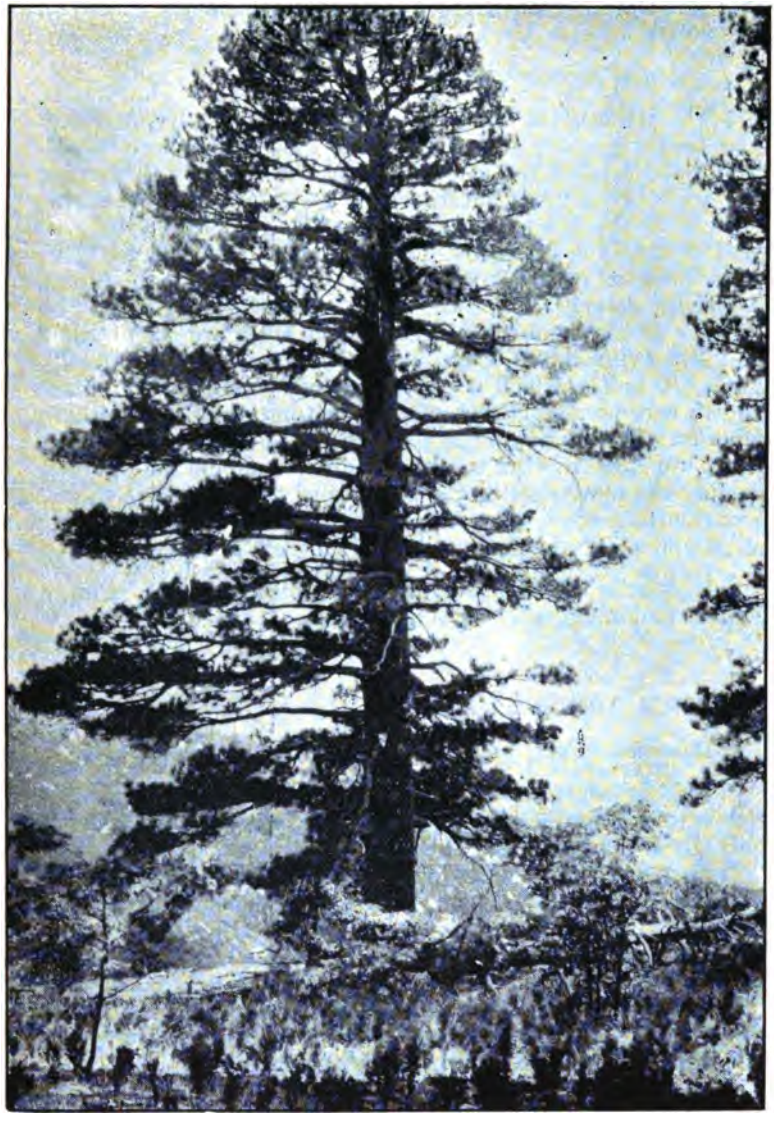
Pinus canariensis (Canary Island Pine), Pretoria.

(1 *) *PINUS CANARIENSIS.*

Canary Pine.

This is a pine with the best reputation for timber. It has been already planted all over the Transvaal, and shows, so far, a growth varying from fair to good. It is not entirely suited to the Transvaal climate, so that both the further growth and the quality of the timber remain subject to experiment. So far the results are encouraging both "en massif" in the Johannesburg plantations and as scattered trees elsewhere. A small mass of these trees at Braamfontein showed an average growth three-fourths that of Insignis pine, the fastest grower there, and their general appearance was quite satisfactory.

Canary Islands, sea-level to 7,000 feet on the Peak of Teneriffe, but most abundant 4,000 to 6,000 feet.



Pinus coulteri (Big Cone Pine), California.

(1) *PINUS COULTERI.*

Big Cone Pine.

Looks well in Mr. Hume's pinetum at Johannesburg. Worth further trial in the drier districts of the Transvaal. "Trees of medium size, with dark green, abundant, three-leaved foliage, composed of very large and long leaves, 10 to 16 inches long."—Lemmon. The cones are the largest known, weighing from 5 to 8 pounds, with spiney scales. It has a long cucumber shape. A large tree, said to be of quick growth.

California, on eastern slopes of coast range, 3,000 to 6,000 feet elevation.

(*1) PINUS CUBENSIS. (*P. heterophylla* of later American writers).

Cubensis or Slash Pine.

This is one of the Pitch Pines of the United States, America. The timber scarcely differs from the best Pitch-pine (*P. australis*) and fetches the same price on the market. This pine has probably a great future before it, in the damp equable climate of the mountains of the North-east Transvaal. Sargent in his Silva of North America, describes it thus :—" The most beautiful of the Pines of the Southern States ; the broad, compact, shapely dark heads of the Slash Pine, raised on massive trunks, stand out boldly among the more open-headed and less symmetrical long-leaved (*P. australis*) and Loblolly Pines (*P. taeda*), which it seems destined gradually to replace and to become a chief factor in the restoration of the southern pineries. For its seedlings, produced in great numbers every year, are able to thrive without direct sunlight, and, overcoming the more slowly growing seedlings of the other species sooner attain sufficient size to resist the fires which endanger all young plants in the maritime Pine belt of the south.

Highlands of Central America, Gulf States of United States, and mountains of West Indies.

(1) PINUS DENSIFLORA.

Densiflora Pine.

This in contra-distinction to *P. thunbergii*, is a pine of rich soils. It is met with planted everywhere in Japan, but only grows naturally on the richer granltic or volcanic soils. " Timber used for every description of carpentry by the Japanese " (Veitch). It is noted growing as a tree 40 feet high in Yunan, 7,000 feet elevation. On the west coast of Corea, it is seen as a stunted tree covering the hills, kept closely cut for firewood, so that it rarely reaches more than one or two feet in height, with clusters of small branches. Near Pekin it is noted growing as a flat-headed tree, somewhat like an old Cedar. (" Index Floræ sinensis."—Dr. Masters.)

Japan and China.

PINUS DOUGLASII (var macrocarpa).–*See* Abietia macrocarpa

(2) PINUS EDULIS.

Edulis Pine.

Probably extends south and is thus suited to the Transvaal. A small tree with eatable nuts.

New Mexico.

(2) *PINUS EXCELSA.*

Excelsa Pine.

Worth trial in the coldest situations in the Transvaal. In Cape Colony showed a poor growth on the Hogsback; does better at Hanover (with water). It might do on the Drakensberg of the southern Transvaal. A poor tree in the middle districts of Natal. Young trees looked doubtful in Mr. Hume's arboretum at Johannesburg, better in the park at Pretoria. This is the best Himalayan common timber after the Deodar. In the Himalayas it grows faster than the Deodar, and thus tends to dominate and oust the Deodar. In good soil and at moderate elevations, says Gamble, it grows very fast. All the trees I have seen in South Africa were slow-growing.

Himalayas, at 6,000-12,000 feet.

(2) PINUS FILIFOLIA.

Filifolia Pine.

Trial planting on wet mountain ground in the northern Transvaal, at lower elevations.

Mountains of Guatamala, latitute 14° to 17°.

(2) PINUS GERARDIANA.

Himalayan Nut Pine.

A small pine, in dry, open, pure forest. It might prove a useful Nut tree for the Transvaal, on the drier mountain sites.

Dry Western and Inner Himalayas, at 6-10,000 feet, from the Deodar Forests to outside the monsoon rains.

(2) *PINUS HALEPENSIS.*

Jerusalem or Aleppo Pine.

Already flourishing at various places in the Transvaal. It is, however, a winter rainfall Pine, and thus not well suited to the climate, nor is it quite a first-class timber. Timber, white with a fine grain, good for carpentry.

South Europe and West Asia, as far as the winter rains extend.

(2) PINUS HARTWIGII.

Hartwig's Pine.

Wet mountain tops of Eastern Transvaal on good soil. On the peak of Orizabe, above 11,000 feet.

Higher mountains of Mexico.

Pinus insignis, Pretoria.

(2) *PINUS INSIGNIS.*

Insignis Pine.

The Insignis Pine has been as largely planted, relatively, in the Transvaal as in Natal. It is a complete climatic exotic in both countries, growing quickly at first, dying early and yielding a soft, woolly, worthless timber. The failure of this tree has caused much disappointment in Natal, where for some time, its various diseases were put down to all causes except the right ones. On the Natal coast, it is a complete failure; inland it lasts from 20 to 25 years, misleading tree-planters by an early rapid growth.

California coast, very resticted in a purely winter rainfall.

(1) PINUS KORAIENSIS.
Korean Pine.

This tree extends over a wide area in China, and still exists wild in Japan. It is cultivated in Japan and in Europe. Veitch describes it as usually a small tree, and in England slow-growing. Worthy of careful trial in the Transvaal.

China and Japan. West Coast of Corea, Manchuria and Japan. ("Index Floræ sinensis."—Dr. Masters.)

(2) PINUS LAMBERTIANA.
Sugar Pine.

The loftiest of all pines and yielding first rate timber (Veitch). Trees up to 300 feet are known. It grows with Redwood and up the mountains to an elevation of 8,000 feet. Its cultivation might be attempted on the wettest mountains of the Eastern Transvaal, but its success is doubtful.

Oregon and California.

(2) *PINUS LARICIO.*
Laricio Pine.

There are some fine, but very slow-growing, trees on the highest mountains of Cypress, and young trees grew fairly on the Hogsback, Cape Colony; but generally the growth in South Africa as in Cyprus, is very slow.

Europe.

(* 1) PINUS LONGIFOLIA.
Longifolia Pine.

This fine timber tree is well suited to the Transvaal climatically. Timber of good medium quality, fast-growing. In the pole stage, can hardly be distinguished from Canary Pine. This tree should be well tried all over the Transvaal, particularly in the north-east forests. I saw various promising trees in Natal, where it grows well up to 4,000 feet elevation.

Outer Himalayas and Siwalik Range, 5,000 to 7,000 feet. Wide-spread from the hot, damp valleys of Sikim to the bleak, dry, stoney hills of the Panjab.

(1) PINUS MANDSHURICA.

Yunan. ("Index Floræ sinensis."—Dr. Masters.)

Climatically suited to the Transvaal,

(1) PINUS MASSONIANA.
Massoniana Pine.

A good timber tree, apparently well suited to the Transvaal, though not yet planted there, unless in Mr. Hume's pinetum at Johannesburg. He certainly has *P. sinensis*, a variety of this. This is fast growing, but not quite healthy. *P. massoniana* appears to be wide spread in China, extending from Yunan and Formosa to North China and Japan.

(2) PINUS MERKUSII.
The Tropical Pine.

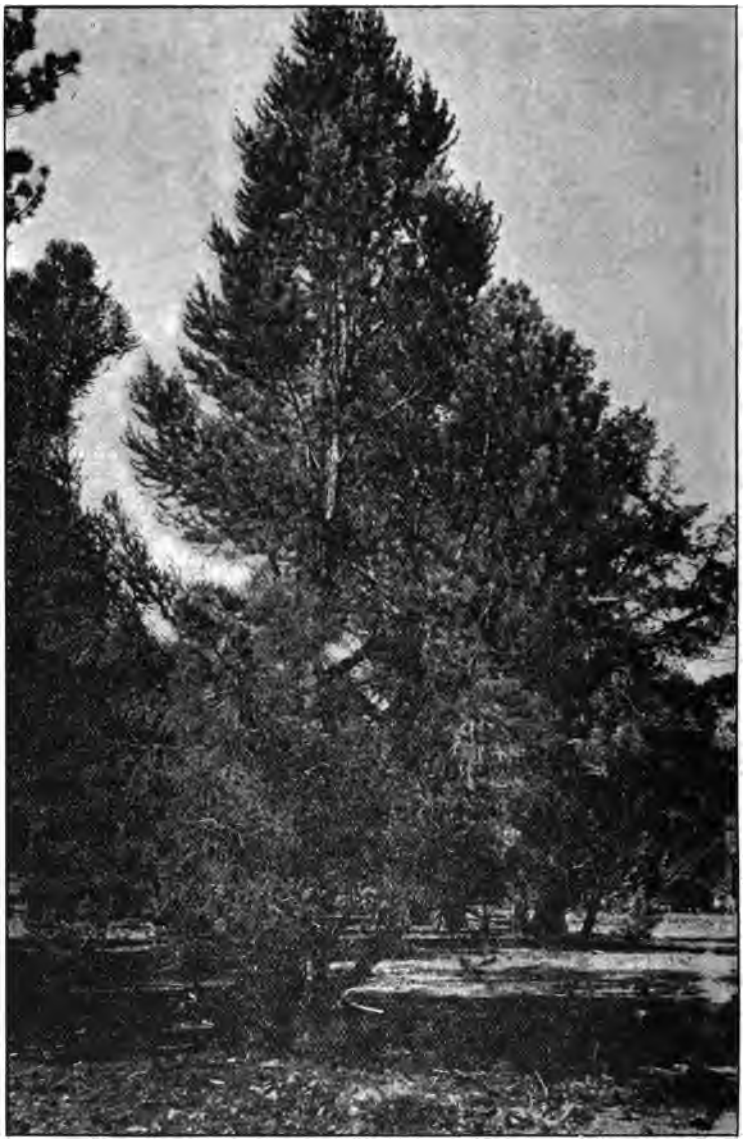
Might be tried in the Low Country, where there is a good rainfall.

Drier mountains of Burmah.

(1) PINUS MITIS (*P. echinata* of the later American authors). *Short-leaved Pitch-pine.*

This is the most valuable Pitch-pine after *P. australis*, and the timber being finer and softer is preferred to *P. australis* for interior work. It should be tried on wet mountain sites of the southern Transvaal. It may succeed at Belfast. In the Transvaal generally this and the other 3 Pitch-pines would suffer from the spring droughts.

New York to Texas; the most northern of the 4 Pitch-pines.



Pinus monophylla (Nut Pine), California.

(2) PINUS MONOPHYLLA.
Stone or Nut Pine.
Very hardy, withstanding any drought or frost, but usually a small ill-shaped tree. It bears an eatable nut, better than the Stone-pine nut. It may be worth planting on any high dry barren mountain sides, but will grow very slowly.
California, South-western States of America, at various elevations.

(1 *) PINUS MONTEZUMÆ.
Montezume's Pine.
The common Pine in Mexico, between 17° and 25° latitude. A valuable timber tree. Easily recognised in English pinetums by its foliage, disposed like mops of very long needles. I know some very good trees at Bicton, South Devon. It should be tried at once in the Transvaal and repeatedly all over the country. On the peak of Orizaba, above 11,000 feet.
Mexico, 4,000 to 12,000 feet.

(2) PINUS OOCARPA.
Oocarpa Pine.
Wet mountain tops of Eastern Transvaal, on good soil.
Higher mountains of Mexico.

(2) PINUS PARVIFLORA.
Parviflora Pine.
This is said to be too small and slow-growing to make it a valuable introduction. It has a useful soft timber, and may be tried in the wetter districts of the Transvaal.
South Japan, to an elevation of 5,000 feet.

(1) PINUS PATULA.
Patula Pine.
Should prove a hardy, useful tree in various parts of the higher Transvaal, but preferably the east.
Mexico, 6,000 to 12,000 feet.

(1) *PINUS PINASTER.*
Cluster-pine.
This is one of the trees that have been taken over from the Cape, without regard to its climatic adaptability to the Transvaal, or the quality of its timber. It is not a first-class timber in its own climate. The quality of its timber and its growth in the Transvaal are open to doubt, though so far the young plantations of Cluster-pine, of which there are several in the Transvaal, show a fair growth. In Natal also well-grown trees may be seen.
Mediterranean. Cultivated throughout the extra-tropical world.

(2) PINUS PINCEANA.
Pinceana Pine.
A handsome tree. Should be well tried in the Transvaal. where the elevation can be reached.
Mexico, 9,000 feet above sea level.

(1) PINUS PONDEROSA.

Yellow Pine.

A first-rate timber Pine, says Sargent. Next to *Abietia douglasii*, the most generally distributed and valuable timber tree of the Pacific forests. The southern form is worthy of extended trial in the Transvaal. There is a well grown specimen in Mr. Hume's pinetum, Johannesburg. The Ponderosa Pine forest is the greatest in America. It furnishes a useful timber, not often first-class, and varying with the climate of so wide-spread a tree. Seed obtained from Texas or Mexico may furnish a useful tree for the drier, colder parts of the Transvaal.

North America, from the wettest country to mountains in the driest country of North America, and southwards to Mexico.

(2) PINUS PSEUDOSTROBUS.

Worthy of thorough trial in the Transvaal, at as high a level as is available. There is a good site on the Wolkberg, near Haenertsburg, for this and the other fine mountain Pines of Mexico.

Mexico, up to 10,000 feet.

(2) PINUS PYRENAICA.

Pyrenaica Pine.

This is a wide-spread Pine with a valued timber. It would be tender to winter and spring drought, except in the dampest parts of the Transvaal.

Mediterranean, Levant and North Persia.

(2) PINUS STROBUS.

White Pine of the Americans. Weymouth Pine of Europeans.

Shows a poor growth at the Cape and was a failure in Mr. Hume's arboretum, Johannesburg. It is, or was, the chief timber tree of the north-east of United States, America.

North America.

(2) *PINUS SYLVESTRIS.*

Scotch Pine.

Scotch Pine shows a fair growth on Table Mountain and on the Hogsback, in Cape Colony; and at Ermelo, there was a healthy looking tree, but it failed completely in Mr. Hume's arboretum at Johannesburg. In Corsica, it occupies the zone above Cluster-pine.

Plains of West Europe, mountains of South Europe.

(1) PINUS TAEDA.

Loblolly Pine.

Though, like the other Pitch-pines of the Gulf States of the United States of America, it is only suitable for the damper parts of the Eastern Transvaal: it is a quick-growing tree and may prove of great value, planted in suitable localities. Its timber is of variable quality. The comparatively slow-growing timber from the primeval forest was equal to the best

Pitch-pine, but the Loblolly Pine timber now coming on the market is coarser, and with a large proportion of sapwood. This timber comes largely from rapidly-grown sparse trees, the re-growth of the ruined forest, its poor quality being a matter of poor forestry.

Gulf States, United States of America, and westward into the dry country as far as low hills in Central Texas (Bostrop County), latitude 30°.

(1) PINUS TEOCOTE.
Torch Pine.
A lofty Pine, suited probably, to the north-east forest country. It yields the Brea turpentine, and the timber is said to be particularly durable.
Mexico, 5,000 to 11,000 feet, on the slopes of Orizaba and elsewhere.

(1) PINUS TERNIFOLIA.
Ternifolia Pine.
A noble Pine, forming dense forests. Probably a very valuable introduction to the Transvaal, at high elevations on the eastern frontier.
Mexico, 5,000 feet.

(*1) PINUS THUNBERGII.
Thunberg's Pine.
The "Cluster-pine of Japan." It is planted on the sea coast, it is planted inland; wherever there is poor or exhausted land to be utilised. It is planted for hundreds of miles along the roads as an avenue tree. Timber resinous and durable. It yields a large part of the firewood of the poorer classes. Thunberg has given his name to our second largest indigenous tree (Podocarpus thunbergii) and his name will also live in one of the best pines for the inland South African climates, wherever there is sufficient moisture throughout the year. I anticipate the success of this Pine on the Woodbush Range.
Japan and Korea. Most parts of Japan, but especially near the coast (C. Hansen). Yunan, North China, Corea and Japan. ("Index Floræ sinensis."—Dr. T. Masters.)

(1) PINUS YUNANENSIS.
Yunan, in woods above Tapintze. ("Index Floræ sinensis."—Dr. Masters.) Resembles *P. massoniana.*

(2) PIPTADENIA CEBIL.
A good sized tree, giving a tan bark. North-east forest country of Transvaal.
Argentine.

(2) PISTACIA MEXICANA.
Mexican Pistacia.
Worthy of trial planting.
Northern Mexico.

(2) PISTACIA TEREBINTHUS.
Turpentine Pistacia.
A small, leaf-shedding tree, yielding the fragrant Chio turpentine. For test planting only.
Countries about the Mediterranean.

(2) PITTOSPORUM PHILLYROIDES.
Pittosporum.
For trial planting in the lower districts of the dry western Transvaal. A little ornamental tree with drooping branches and fragrant flowers.
Continental Australia.

(2) *PITTOSPORUM UNDULATUM.*
Pittosporum.
A favourite avenue tree in Australia. A few good specimens at the Cape. It has fragrant leaves and flowers. Tender to drought and frost in the Transvaal.
Queensland and East Australia.

(1) *PLATANUS ORIENTALIS.*
Plane Tree.
A noble shade tree that will succeed well in the Transvaal. It must be planted near water, however, like Willow, or the spring drought will stunt it. There are some good trees at Irene and elsewhere. Timber second-rate.
Mediterranean and Himalayas.

(2) PLATANUS WRIGHTII.
Wright's Plane Tree.
Probably hardier in the Transvaal than the common Plane tree. I cannot say if it is as good a tree.
Mexico.

(2) *PLUMBAGO CAPENSIS.*
Plumbago.
This useful hedge plant, widely planted in South Africa and elsewhere, is killed to the ground by frost in the colder parts of the Transvaal.
South-east Cape Colony.

(2) PRUMNOPITYS ELEGANS (Podocarpus andina).
The Lleuque of Chili.
A stately tree, bearing eatable cherry-like fruits. It should be tried in the north-east forest country, the home of the two South African *Podocarpus*. I follow the Kew list in writing *Prumnopitys elegans*, but the second name seems preferable.
Chili to Ecuador.

(2) PODOCARPUS ARGOTÆNIA.
It appears to grow to a large tree. Dr. Masters in the "Index Floræ sinensis" mentions five other species of Chinese *Podocarpus*.
Mountains of Formosa and Southern China.

(2) PODOCARPUS CHINENSIS.
Chinese Yellow-wood.
Wood white; durable indoors. This tree from Yunan may prove a useful introduction.
Yunan, China and Japan.

(2) *PODOCARPUS THUNBERGII.*
Upright Yellow-wood.
This is the well-known tree of the indigenous forest. Being a native tree, it has been planted at various places at the Cape and Natal, but the growth is too slow and the propagation too uncertain, ever to make it a tree profitable to plant for timber. So also the larger *P. elongata* or Outeniqua Yellow-wood. In the indigenous forest the cuttings will favour their reproduction. I saw some fairly grown planted trees in Natal. They require shade and shelter when young.
South Africa, Capetown, to north-east Transvaal.

(2) PODOCARPUS THUNBERGII. (Var falcata.)
Falcata Yellow-wood.
A round-headed tree, with drooping foliage, looking more like a weeping Yew than a Yellow-wood. I saw several specimens in the middle districts of Natal. A very effective ornamental tree. North-east forest country.
South Africa, indigenous.

(2) *POPULUS ALBA.*
White Poplar.
Now naturalised in the Transvaal. The "Poplar bush" is to be seen on most Boer farms where there is any swampy ground. It furnishes a perishable, second-rate timber, but one which is useful enough on a farm in default of a better. Its planting should be abandoned for that of some of the better timbered Poplars, or good timbers such as Blackwood that like damp ground and can stand a fair amount of excessive wet.
Eurasia.

(2) POPULUS BALSAMIFERA.
Balsam Poplar.
Leaves balsamic. Flourishes in very dry country on damp or brak ground. For trial in the Western Transvaal.
Dry Inner Himalayas and Thibet.

(2) POPULUS CILIATA.
Himalayan Aspen.
Worth trial. Wood white, soft.
Himalayas, 4,000 to 10,000 feet.

(2) POPULUS EUPHRATICA.
Euphrates Poplar.
Better wood than the common Poplar. A fine, quick-growing tree with useful timber. Generally a river-side tree (Brandis).
Algeria to Himalayas.

(2) POPULUS FREMONTII.
Fremont's Poplar.
A fine avenue tree. Plant near water.
Western America.

(2) POPULUS NIGRA.
Black Poplar.
Common in the Transvaal. The upright variety is the Lombardy Poplar. Wood little used (Gamble).
Europe and Asia; wide-spread.

(2) PROSOPIS ALBA.
Algaroba Blanca.
Yields a sweet pod. Suitable for the dry Western Transvaal. A farmers' tree.
Argentine.

(2) PROSOPIS DULCIS.
One of the Mesquit Trees.
Yields the well-known Mesquit Bean. Tree like the South African Mimosa thorn. Suited to the driest and hottest parts of the Transvaal. A farmers' tree.
North and South America.

(2) PROSOPIS HORRIDA.
Algaroba.
Yields a valuable sweet pod. Introduced very successfully to Hawaii, where it feeds herds of swine, like an oak copse. Suited to the dry western districts of the Transvaal. A farmers' tree.
South America.

(2) PROSOPIS JULIFLORA.
Mesquit.
A valuable tree, but slow-growing. Wood indestructible in the ground (Sargent). Suited to the very driest part of the Transvaal.
Texas and North Mexico.

(2) PROSOPIS PUBESCENS.
The Tornillo.
Yields Mesquit pods. Suited to the Western Transvaal.
Mexico.

(2) PROSOPIS SPICIGERA.
Of slight value for its sweet pods and perhaps hedge purposes. Hardy, but slow-growing. Worth trying in the dry districts such as Potchefstroom.
India and Persia.

(2) PRUNUS AMYGDALUS.
Almond Tree.
Grows to a large size, especially near water in dry countries. There are some noble trees in South Africa.
Mediterranean and Persia.

(2) PRUNUS CAPULI.
Capulinos Tree.
Yields the Capulinos fruits. Worthy of trial in the Transvaal.
Mexico.

(2) PSIDIUM ARACA.
A Guava.
A good fruit Guava, flourishes on dry, high ground (Mueller) Seems worth trial in the Transvaal.
Peru and Brazil.

(2) *PSIDIUM CATTLEYANUM.*
The Purple Guava.
Already planted in the Transvaal.
Brazil.

(2) PSIDIUM CHRYSOPHYLLUM.
The Guabiroba de Mato.
Worth introduction.
Brazil.

(2) PSIDIUM CINEREUM
Guava.
Worth introduction.
South Brazil.

(2) PSIDIUM GRANDIFOLIUM.
Guava.
Worth introduction. A dwarf species.
Brazil.

(2) PSIDIUM INCANESCENS.
Guava.
Worth introduction. A dwarf species.
Brazil.

(2) PSIDIUM RURUM.
Guava.
Probably suited to the north-east forest country.
Brazil, on higher mountains.

(2) PTEROCARYA FRAXINIFOLIA.
Ash-leaved Walnut.
This is said to closely resemble the common Walnut and to be fast-growing. It may prove hardier in the Transvaal than the common Walnut. Seed can be obtained in North America, where it is under cultivation.
Asia.

(1) *PTEROXYLON UTILE.*
Sneezewood.
The well-known imperishable timber of South Africa. The extent of the durability of Sneezewood heartwood is

unknown. Test plantations should be made in the warmer, wetter parts of the Transvaal, in order to see if it can be grown economically, to compete with iron, and the somewhat less durable but much faster growing, Eucalypts such as Ironbark, Tallow-wood and a few others.

Mountains of South-east Africa, from the southern coast to Zululand, and how much further north not known; said to occur in the Low Country, north-east Transvaal.

(2) QUERCUS ACUTIFOLIA.

Acutifolia Oak.

Test-planting only.

Mexico, 6,000 to 8,000 feet.

(2) QUERCUS AEGILOPS.

Valonia Oak.

Yields the valuable tan material and has been planted both at the Cape and Natal. Growth always poor and the tree generally unhealthy. Grew 5 feet in 7 years at Hilton Road, Natal. May be tried in the north-east Transvaal. Of doubtful success in the Transvaal. About £500,000 worth of Valonia yearly exported to England.

Eastern Mediterranean.

(2) QUERCUS AGRIFOLIA.

Oak.

Slow-growing and with inferior timber, but worth trial as an evergreen shade tree. It grows to a magnificient tree in Mexico.

Mexico.

(2) *QUERCUS ALBA.*

White Oak.

The most valuable of the North American Oaks. It shows, however, but a poor growth in Cape Colony and in Mr. Hume's arboretum, Johannesburg.

North America, extending south to Florida.

(2) QUERCUS BALLOTA.

Sweet Acorn Oak.

A variety or sub-species of Q. suber, and hardly better suited to the climate of the Transvaal. Q. ballota might be tried on the Woodbush Range. Yields an acorn, eaten like a chesnut.

Algerian Mountains.

(1) QUERCUS CASTANEA.

Chesnut Oak.

Produces eatable acorns. May be a valuable introduction to the Transvaal.

Mexico.

(2) QUERCUS CHRYSOPHYLLA.
Chrysophylla Oak.
Wood bush Range, etc.
Mexico, 6,000 to 8,000 feet.

(2) *QUERCUS COCCINEA.*
Black Oak.
This is one of the largest of the North American Oaks, but the timber is hard and second-rate. In the Transvaal, it should be tender to spring drought. A single specimen in Mr. Hume's arboretum, Johannesburg, showed an excellent growth and measured 9 feet in height at 5 years of age.
Eastern States, United States. America, extending south to Florida.

(2) QUERCUS CORRUGATA.
Oak.
Seems well suited along with other Mexican Oaks to the north-east forest country of the Transvaal.
Mexico, 5,000 to 8,000 feet.

(2) QUERCUS CRASSIPES.
Crassipes Oak.
Trial planting in damp mountain localities.
Mexico, 6,000 to 8,000 feet.

(2) QUERCUS DILATATA.
Thorn Oak.
A large, nearly evergreen tree, with shining green foliage; prefers moist ravines (Gamble). Timber, however, too heavy (61 lbs.)
Inner Himalayas, up to 7–9,000 feet.

(2) QUERCUS ILEX.
Ilex or Holm Oak.
Handsome evergreen shade tree, but timber mediocre. It is worth planting as a shade tree in the cooler, damper parts of the Transvaal. In Mr. Hume's arboretum at Johannesburg, it grew 14 feet in 5 years. Poor, scrubby growth, Tophams, near Maritzburg, in Natal.
Mediterranean and inner dry Himalayas.

(2) QUERCUS INCANA.
The Ban Oak.
Inferior timber; a large evergreen tree, well-suited to the wetter climates of the Transvaal.
Himalayas, 2,000 to 8,000 feet.

(2) QUERCUS INFECTORIA.
Gall Oak.
A shrub or medium sized tree, yielding the Galls of commerce.
Mediterranean to Persia.

(2) QUERCUS LANCEOLATA.
Lanceolata Oak.
Test planting in damp mountain localities.
Mexico, 6,000 to 8,000 feet.

(2) QUERCUS LOBATA.
Lobata Oak.
Worthy of trial on well watered mountain sites in the Transvaal.
Mexico, 5,000 to 8,000 feet.

(2) QUERCUS MACROLEPIS.
Valonia Oak.
Closely allied to Q. aegilops, and perhaps hardier.
Greece.

(2) QUERCUS MAGNOLIFOLIA.
Silkworm Oak.
Its leaves feed a silkworm. Woodbush Range, etc.
Mexico.

(1) QUERCUS MICHAUXII.
Michau's Oak or Cow Oak.
This is an oak yielding good timber and large crops of fine acorns, sweet as a chesnut, but it is useless to attempt to grow it except in moist country, such as the Woodbush Range.
South-eastern States, United States, America.

(2) QUERCUS OBTUSILOBA.
Post Oak.
A widespread medium sized, leaf-shedding Oak, with coarse timber, that seasons badly, but is durable in the ground and is much prized in the south-west of the United States, for posts and sleepers. Should be well tried in the Eastern Transvaal.
Texas.

(2) QUERCUS RECTICULATA.
Recticulata Oak.
Fair timber. Should be well tried in the Eastern Transvaal.
Mexico.

(1) *QUERCUS ROBUR* (*var. pedunculata*).
The British Oak.
The common Oak, naturalised at the Cape. An ornamental and fruit tree there. Fails on the mountains of South India. A poor tree on the Himalayas. The common Oak must be looked on as near its northern limit in the Transvaal, half hardy and not a forest tree. The largest plantations in the Transvaal are on the estate of Mr. S. Marks, at Vereeniging,

where a deep, open soil provides moisture in spring. This is the chief condition of success for the common Oak in the Transvaal. It is owing to the neglect of this, that it is often seen in a stunted condition.

Europe and Asia Minor. Rare in Algeria.

(2) QUERCUS SEMECARPIFOLIA.

The Karshu Oak.

A fine, evergreen tree, yielding timber of good quality and forming large, pure forests, beginning practically where that of the "Moru" *Q. dilatata* ends (Gamble). Might be useful for fire-lines with the high-mountain Mexican Pines mentioned above.

Drier inner Himalayas, 8,000 to 12,000 feet.

(2) QUERCUS SIDEROXYLON.

Ironwood Oak.

A magnificient Oak, with timber that is hard and of some durability.

Mexico, 5,000 to 8,000 feet.

(1) QUERCUS SKINNERI.

Cozahual.

Perhaps the best of the Mexican Oaks. A leaf-shedder with strong and durable timber and a fine, large acorn. A very desirable tree for mountainous, well-watered country in the Transvaal.

Mexico, 7,000 feet on limestone.

(2) *QUERCUS SUBER.*

Cork Oak.

Fails on the Himalayas, and is rarely hardy, even in the west of Cape Colony, where it gets the Mediterranean climate. I was, therefore, surprlsed to see quite healthy middle-aged trees in Natal. It should be planted with caution in the Transvaal. The French Forest Department hold such large stores of Cork Oak in Algeria that there is no prospect of remunerative planting for cork.

South Europe and North Africa.

(2) QUERCUS VIRENS.

Live Oak.

A hard, fairly durable timber.

Mexico.

(1) QUERCUS XALŒPENSIS.

Poverty Oak.

Grows on poor, clayey soil; quick-growing. Yields large crops of acorns. This may prove an invaluable tree for planting up the sour veld soil in the forest glades of the north-east forest country, especially if it should prove a good barrier against fire.

Mexico, up to 5,000 feet.

(2) RHUS CORIARIA.

Sumach Shrub.

This is the shrub yielding the Sumach of commerce. May be tried experimentally in the lower Transvaal districts.

Mediterranean.

(2) RHUS RHODANTHEMA.

Jango-jango or Yellow Cedar.

A fine tree with lustrous Ceda-like timber. May suit the lower elevations of the north-east forest country, where there is a good rainfall, or the border of streams elsewhere, say Swaziland.

Queensland, a water-side tree.

(1) *ROBINIA PSEUDACACIA.*

Robinia.

It is best developed on the mountains of West Virginia (Sargent). Widely cultivated in Europe and America. Does well in the coldest districts of Cape Colony. Widely planted in the Transvaal, but all the trees I saw were small. The stems make good split fencing posts.

North America.

(2) SABAL PALMETTO.

Palmetto Palm.

An enormous, extra-tropical Fan Palm, giving a timber resistant to decay and Teredo. Would probably do well in the Woodbush Range, or perhaps better at a lower elevation than the indigenous forest. There is a handsome specimen in the Botanical Gardens, Cape Town.

Florida to North Carolina.

(2) *SALIX ALBA.*

White Willow.

One of the most useful of the Willows. Already growing in the Transvaal.

West Himalayas, to 6,000 feet and widespread.

(1) SALIX AMYGDALINA.

Almond Willow.

One of the best osier Willows.

Europe and Asia.

(2) *SALIX BABYLONICA.*

Weeping Willow.

The well known Weeping Willow.

Persia, widely cultivated.

(1) *SALIX CAPREA.*

The Sallow.

On the whole this is the hardiest Willow of those yet cultivated at the Cape for osiers, and it makes a good basket. I saw a well-grown young tree in Mr. Hume's arboretum at Johannesburg (5,760 feet elevation and 12° frost).

Europe and Northern Asia.

(1) *SALIX CINERIA.*

Sallow.

Has been grown successfully at the Cape for many years. Produces a good basket osier.

Europe.

(2) SALIX DAVIESII.

Davies' Willow.

Worth trial in the Transvaal.

Persia.

(1) SALIX HUMBOLDTIANA.

Humboldt's Willow.

Should be hardy in the Transvaal.

South America, widespread.

(1) SALIX PURPUREA.

Bitter Willow.

A good osier Willow and one of the best for introduction.

North Africa and widespread.

(2) SALIX RUBRA.

Rubra Willow.

Cultivated as an osier in North Africa. Worth trial in the Transvaal.

North Africa.

(1) SALIX TETRASPERMA.

Tetrasperma Willow.

The chief Indian Willow, a leaf-shedder and a fine large tree. Timber red and soft, quick-growing. Yields both timber and twigs.

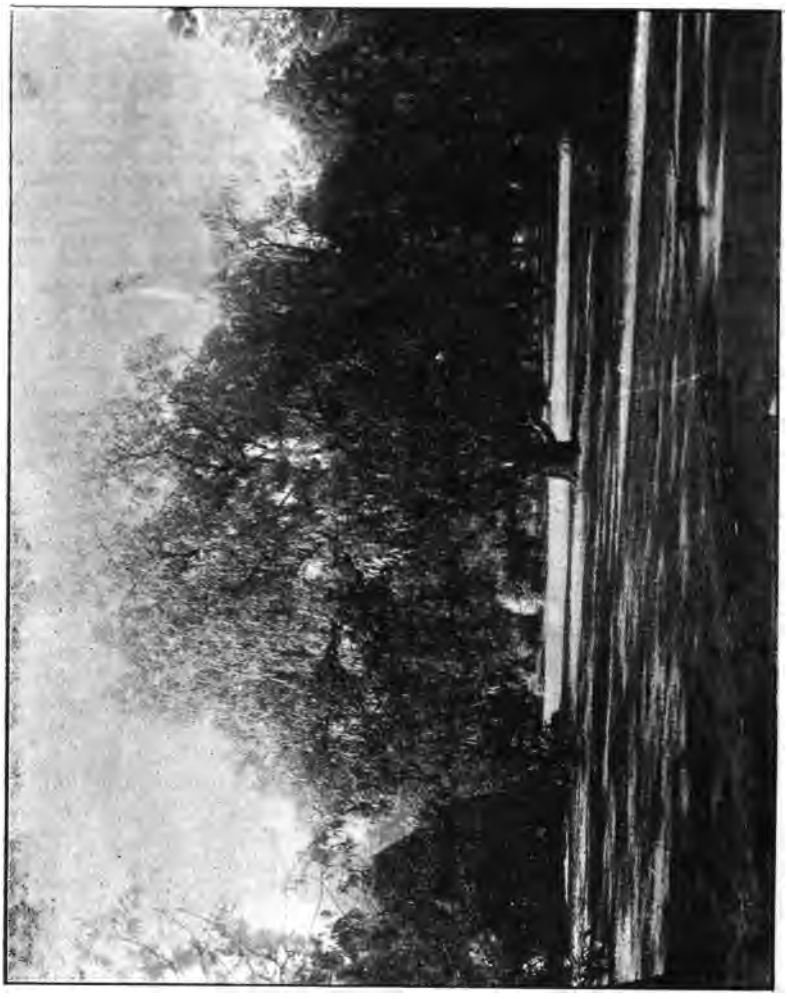
India and Himalayas, to 6,000 feet.

(1) SALIX VIMINALIS.

Osier Willow.

This is the common Osier of European Osier beds. It will probably do well in the Transvaal, if watered well in spring.

Inner Himalayas, 5-9,000 feet, extending west to Europe.



Schinus molle (Pepper Tree), Pretoria.

(1) *SCHINUS MOLLE.*

Pepper-tree.

One of the best ornamental trees for the drier, warmer parts of the Transvaal. It is killed by frost in the colder parts.

Andes of South America, widely cultivated.

(2) SCLEROCARYA CAFFRA.

Marula.

This is a tree with a soft, perishable timber and a fruit the size of a small apricot, much used in making Kaffir beer. Possibly the fruit might be used otherwise, and the tree grown for ornament, as it is a leaf-shedder, with rather pretty ash-like foliage and spreading branches.

Abundant in the open, scrub-like forests of the lower Transvaal.

(2) SKIADOPITYS VERTICILATA.

Skiadopitys.

A curious tree, with a straight, useful timber, that should be tried on wet, peaty mountain tops in the Transvaal. In Japan it grows with a slender, well-shaped stem to a height of 100 feet.

Japanese Mountains.

(2) SEQUOIA SEMPERVIRENS.

Redwood.

One of the finest timber trees in the world; this tree is worth trying on the Woodbush Range, though I scarcely expect it to succeed there. I saw only two trees in Natal. Its cultivation so far in Cape Colony shows little hope of final success.

California.

(1) SHOREA ROBUSTA.

Sàl.

A large, nearly evergreen tree, forming more pure forest than any other Indian tree (Gamble). It requires over 40 inches rainfall and loose sandstone or gravelly soils (Brandis). It has an abundant natural reproduction both from seed and coppice. Its timber is a little heavier and stronger than Teak, but not quite so durable. It seasons badly. The tree yields resin freely when tapped, and resin in the ground like Kauri. It is largely used for sleepers, and is the most abundant timber of Northern India. It is not fast-growing, and only test plantations can show whether it is worth planting extensively in those parts of the Transvaal suited to it. Sàl seed is difficult to procure good, in fact, it frequently starts germinating before it is shed when on the trees. It is stated that it can be kept in damp ground for six weeks.

Outer Himalayas, heavy and moderate rainfalls up to 4,000 feet, and rarely higher (Gamble).

(2) STENOCARPUS SINUOSUS.

Tulip Tree.

A tall, handsome tree, with large bunches of brilliant Scarlet flowers about April. Timber like the European Beech. Worth trial in the lower eastern districts.

Eastern Australia.

(2) *STERCULIA ACERIFOLIA.*

Flame Tree of Eastern Australia.

Produces masses of crimson flowers; will not stand severe frost. A fine tree, 20 inches diameter and 50 feet high, with dense, dark foliage and brilliant red flowers in the Botanical Gardens at Maritzburg. A smaller, well-grown tree at Irene.

Eastern Australia.

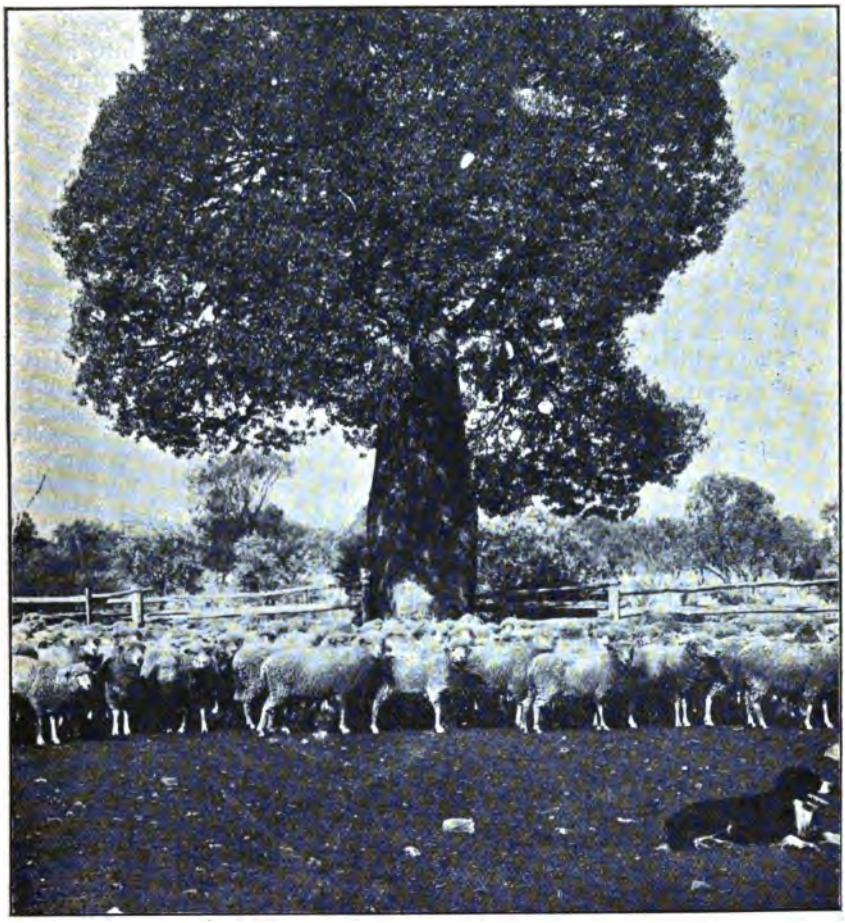
Sterculia diversifolia (Currajong), Irene.

(2) *STERCULIA DIVERSIFOLIA.*

Currajong.

A valuable fodder tree in time of drought. Greatly prized in Australia. Several fine trees at Irene and elsewhere in the Transvaal. Not a timber tree.

Eastern Australia.



Sterculia rupestris (Bottle Tree), Queensland.

(2) *STERCULIA RUPESTRIS.*
Bottle Tree.

A highly-prized fodder tree. Cattle eat it all down to the chips of the wood, so it is said.

Queensland.

(1) *SYNCARPIA LAURIFOLIA.*
Turpentine Tree.

A good tree for all underground work, best as round piles, in which form it resists Teredo well. Fire-resistant in beams of a house. Does well below 4,000 feet in the Transvaal. There is a fine straight tree 60 feet high in the Maritzburg Botanical Gardens. "Forms," says Professor Maiden, "magnificent straight trees in deep gulleys." It is found in the north coast forests of New South Wales.

Queensland.

(2) TAMARIX ARTICULATA.

Tree Tamarisk.

One of the most important desert trees, growing into a large tree like a Conifer (Gamble). An important tree for the dry Western Transvaal near the Bechuanaland border.

India and North Africa into the Sahara.

(2) *TAMARIX GALLICA.*

The Common Tamarisk.

Very widespread, but generally does best in South Africa on dry, partly brackish ground. The hardiest tree in the Karroo. This and T. articulata are planted for fuel in India. Both are trees of dry climates, with irrigation or subsoil water. They will be useful in the Western Transvaal.

South Europe, Northern and Tropical Africa.

(2) TAMARIX ORIENTALIS.

Tamarisk.

Should be tried in the Western Transvaal.

Northern and Middle Africa.

(2) TARRIETIA ACTINOPHYLLA.

Stave Wood.

A very large tree, with spreading head of a deep green, dense foliage, and numerous white flowers. Timber tough like English Ash, and bending better than Ash (Bailey). Suitable for Swaziland and the lower well-watered country.

Mountains of Queensland and New South Wales.

(2) *TAXODIUM DISTYCHUM.*

Bald Cypress.

This is very like *Taxodium mucronatum*, to which climatically, in the Transvaal, it is very inferior. The Bald Cypress fails gradually at the Cape, especially in swampy ground where it might be expected to succeed. Fairly grown specimens may be seen both in the Transvaal and Natal. Does well in the Botanical Gardens, Maritzburg. There is a tree there 15 inches diameter and 50 feet high. Mr. Legat tells me it is doing fairly well in the streets of Klerksdorp, and there were healthy young trees in Mr. Hume's arboretum at Johannesburg, but all Transvaal growers should prefer the Mexican tree.

North America.

(1) TAXODIUM MUCRONATUM.

Montezume Cypress.

The best known of the Mexican Cedars. It forms pure forest at about 5,000 feet, and various noble trees are referred to by travellers in enthusiastic terms. The Mexican tree is closely allied to the American *Taxodium distychum*, which is already growing in the Transvaal. If this magnificent tree be

not too slow-growing, it is evidently destined to take an important part in the Transvaal forestry of the future. Extends to Southern Mexico as far as Oajaca in latitude 17°, rainfall 28 inches. Sargent says that the best European botanists studying the American and Mexican trees as growing side by side in Italian gardens, consider them specifically distinct. *T. mucronatum* is widely scattered over Eastern and Southern Mexico, that is to say, the wetter parts of Mexico. The largest of the Mexican trees on record is that at Tule, with a mean diameter of 30 feet, a height of 150 feet, and a branch spread of 141 feet. This tree is believed to be 2,000 years old. The celebrated Montezume Cypress, in the gardens of Chepultepec, at Mexico City, is somewhat higher, but of much less diameter. This tree is over 7 centuries old!

Mexico, 5,000 to 8,000 feet, forming extensive forests.

(2) TECTONA GRANDIS.

Teak.

It would be possible to grow Teak in the low country where there is a heavy rainfall, but hardly in remunerative plantations. It takes 100 years to mature. See my note, Page 18, Matapo Report. In Transvaal forestry, Teak will probably be replaced by some of the fine Cedars for which the Transvaal is so well suited. Teak shows but a poor growth at Durban, Natal (Botanical Gardens).

Tropics; in India to latitude 25°, in a scrub form; to 4,000 feet elevation in a stunted form on tropical mountains.

(2) TELOPEA SPECIOSISSIMA.

Waratah.

May flourish on the Woodbush Range and be cultivated elsewhere for its splendid flowers. Flourishes on the Nilgiris, Southern India.

New South Wales, Gippsland, and Tasmania.

(2) TERMINALIA CHEBULA.

Black Myrobolan Tree.

A large, leaf-shidding tree, yielding the valuable Myrobolan tan nuts. Timber very hard and strong, and durable to some extent. Barberton and the lower forest country.

India, to 5,000 feet, and Upper Persia.

(2) THUYA ORIENTALIS.

Arbor-vitae.

Cultivated widely for hedges in the Transvaal, but much subject to Aphis.

China and Japan. Hills west of Pekin. ("Index Floræ sinensis."—Dr. Masters.)

(2) TORREYA NUCIFERA (*Tumion nucifera* of the later American botanists).

Japanese Torreya.

Usually a small but sometimes a large tree. The large tree is described as a conifer of unusual beauty with its bright red bark and very dark green (almost blackish green) foliage. The small tree may be useful as forest cover. The kernels of the seed are an important article of food in Japan, and yield a useful cooking oil (Sargent). Dr. Masters, in the "Index Floræ sinensis," mentions this tree as growing in Northern China.

Southern Japan and China.

(2) TORREYA GRANDIS. Found on the mountains of Chekiang. ("Index Floræ sinensis."—Dr. Masters.)

(2) *TRISTANIA CONFERTA.*

Brush Box.

A gardener's name for this tree is "Lophostemon." Timber durable, but liable to warp. One of the most handsome avenue trees of Australia. A fine tree like a Eucalypt. This has the reputation of the best-foliaged tree in Natal. There is a fine specimen in the Maritzburg Botanical Gardens.

Usually found in the dense forests of the northern New South Wales coast, termed "Brushes," often, however, in open forest.

(2) TSUGA ARARAGI (*Tsuga sieboldii*).

Araragi Spruce.

A beautiful tree, 60 to 80 feet high (Sargent). Replaces *Tsuga diversifolia* south of Nikko. Only suitable for the wettest climates in the Transvaal.

Mountains of Southern Japan, in dry, stoney valleys.

(2) TSUGA BRUNONIANA.

Himalayan Hemlock Spruce.

This and *Tsuga araragi* are the only two of the graceful Tsugas with any chance of permanently succeeding in the Transvaal, and it is probably useless to try them anywhere except on the Woodbush Range, or in similar damp country. T. brunoniana is a fine forest tree in the wetter Himalayas, but slow-growing and the timber mediocre (Gamble).

Central and Eastern Himalayas, 8,000 to 10,000 feet.

(2) TSUGA BRUNIANA (var. chinensis). Szechuen and Yunan. ("Index Floræ sinensis."—Dr. T. Masters.)

(2) TSUGA YUNANENSIS. Yunan. ("Index Floræ sinensis."—Dr. Masters.)

TUMION NUCIFERA.—*See* Torreya nucifera.

(2) ULMUS CRASSIFOLIA.
Cedar Elm.
A large tree, yielding, it is said, valuable timber. Worth trying in the Transvaal.
Mexico.

(2) ULMUS MEXICANA.
Mexican Elm.
Probably in the Transvaal much hardier than the common European Elm.
Mexico.

(2) UNGNADIA SPECIOSA.
Spanish Buckeye.
A small tree, worth trial planting in the Transvaal.
Mexico.

(1)
Argentine Cedar.
This is probably a Cedrela. It is said that there are great forests of it, and that the timber resembles Mahogany.
Mountain slopes of Tucuman.

(1)
Lapacho.
This is a fine tree, said to be widely spread in the upper provinces of Argentina. The timber very durable and much used in building and other purposes.
Upper Argentine.

(1)
Urunday.
Timber very hard and ornamental, being veined with white or yellow veins and spots. It is said to be extremely durable.
Argentine.

(2)
Viraru.
The timber of this tree is described as oak-like, and similar to Lepacho, but not growing to the same height.
Argentine.

THE TREE FITTED TO THE CLIMATE.

In compiling this list two points were kept in view—(1) climatic fitness, (2) use of the tree for timber or ornament. The list is mainly one of such trees as are calculated to produce the timber now imported to the Transvaal, and there are not in it many trees which have a purely ornamental value. Climatic fitness is the crux of the list, and on that every care has been bestowed. In tree-planting, the Transvaal, like others of the South African Colonies, has planted its trees entirely neglecting this most important consideration of climatic fitness. It is a fault which is not confined to the Transvaal. The attempt to plant trees, irrespective of their climatic fitness, began in Europe on a large scale shortly after the colonization of America, and in spite of the similarity between the climates of Europe and many parts of the United States of America, the general result has been one of failure. It was considered at one time that fortunes were to be made in the planting of *Robinia pseudacacia*, and Michaux had great expectations from the introduction of the Pitch-pines to Southern Europe. The Robinia has proved a partial success, but few of Michaux Pitch-pines now remain. *Quercus rubra* and *Acer sacharinum* are of use only as ornamental trees in Europe, and *Juniperus virginia*, widespread over the whole of North America, is slowly dying out in Faber's plantation near Nurnberg, in Germany.

When it is attempted to transfer trees from Northern Europe to South Africa the climatic difference is greater, and only those trees really naturalise which, growing in Northern or Mid-Europe, extend also to Southern Europe. Thus, we have the South European *Quercus pedunculata* half hardy in the damper parts of South Africa, the Cluster-pine, the Stone-pine, the Aleppo-pine, and other trees of Southern Europe quite hardy in Cape Colony. But South European trees are not suited for the Transvaal. In the Mediterranean region there is one rainy season, winter; in the Transvaal, one rainy season, summer. Trees from the Mediterranean region of Southern Europe are entirely out of place in the Transvaal. The same remark applies to the winter-rainfall trees of California and of West Australia. Yet we see these trees have been planted indiscriminately in the Transvaal. It has been assumed that, because they grow in the western winter rainfall of Cape Colony near the coast, they would succeed on the Transvaal inland plateau, with its purely summer rainfall. Hence, a large proportion of the trees that have been planted in the Transvaal must sooner or later fail, and it is important at the outset, to avoid undue disappointment,

that the blame of this failure should be rightly apportioned. If we see failure arise in Jarrah, Kari, Saligna, Wattle, and other trees from West Australia; in Macrocarpa Cypress, Insignis Pine, Muricata Pine, and other trees from California, or in the well-known trees of Southern Europe, this failure is only what is to be expected, and no conclusion can be drawn in consequence with regard to general tree-growing in the Transvaal. A tree which is a climatic exotic may fail at once, as does the Horse Chestnut in the Transvaal; or it may grow well for a number of years, say 30 or 40 years, and then fail; or it may grow fairly, like so many of the American trees in Europe, and yet produce worthless timber quite different from that produced by the tree in its own home. Thus, *Quercus rubra* of America produces soft wood of little value in Europe The Deodar, so fine a timber on the Himalayas, produces soft, nearly scentless and perishable, wood in Europe.

Climatic unfitness is well shown in the behaviour of the common Horse Chestnut in Johannesburg, which comes into leaf twice—(1) in spring, (2) on the arrival of the summer rains. This tree grew six inches in five years in Mr. Hume's arboretum in Johannesburg, and then died.

TRANSVAAL WEATHER AND TREE-PLANTING.

Range of Temperature.

The mean temperature at Johannesburg is 62 degrees. The mean temperature of places situated at a lower elevation than Johannesburg is higher in the ratio of about 3 degrees per 1,000 feet. The Transvaal, like other plateaux in low latitudes, shows a moderate difference of temperature between summer and winter, a large difference between day and night. The difference between the mean summer and winter temperatures of Johannesburg is 20 degrees, which is about one-third higher than the similarly situated plateau of Mexico, Mexico having the sea on two sides, while the Transvaal has a desert on its western side. June and July are the coldest months in Johannesburg, with a mean temperature of 49 degrees; December and January the hottest, with a mean temperature of 69 degrees. The summer temperature of Johannesburg is the same as the Cape Peninsula, the winter temperature 5 degrees colder; but the shorter winter and longer summer of Johannesburg combine to give it a mean temperature nearly 1 degree above that of the Cape Peninsula, that is, 62 degrees.

WINTER.

In the Transvaal they speak of *two months winter and two months wind.* During May and part of June and July the evaporation from the moisture in the ground after the summer rains and the comparatively low sun combine to establish the Continental anti-cyclonic type of weather, with cold frosty nights and beautiful bright still days. During August and part of July and September the increasing power of the sun breaks up the anti-cyclone, and the ordinary eastward-travelling winter storms of the Cape sweep across the country with terrible dust in all the large towns, and alternations of warm and cold winds. In the Transvaal there are no hot winds, at any time, as in the south. Anything like the hot "berg" wind of the south coast of Cape Colony is naturally impossible.

SPRING.

September and October, the spring months in the Transvaal, are perhaps the least pleasant of the year. The south-east rains are beating up, and the weather is often described as the most oppressive and unpleasant of the year. The dryness of the Transvaal spring excludes a large number of trees that would otherwise flourish in the Transvaal.

SUMMER AND ITS RAINS.

In November the rains set in steadily and continue, with breaks, till April. The rain, as in Mexico, mostly falls in the form of afternoon thunder showers. The governing factor in both the distribution and intensity of these summer rains is the South-east Trade wind. Rain in the Transvaal fails when the South-east Trade wind is either weak or deflected. The Cape weather cycles also have an influence on Transvaal weather, but to what extent is not yet known. The strengthening of the south-east trade and a strong Cape rain cycle falling due in 1904–05 point to an early end of the severe drought which has stricken the Transvaal during the last five or six years.

While the South-east Trade wind brings the moisture to the Transvaal, the precipitation of the moisture is caused either by storms or mountain ranges. Hence the heaviest rainfalls occur along the eastern edge of the plateau, and it is here that there are situated the most favourable sites for timber plantations and the future timber supplies of the Transvaal. In the north-east of the Transvaal, between 4,000 and 6,500 feet, occurs the best-watered part of the country, and here also is the

pleasant sight of from 50 to 70 square miles of large-timbered indigenous forest. which scarcely differs from the same forest at Knysna or in the so-called Yellow-wood belt of Natal.

After the South-east Trade winds have been drained of much of their moisture, they pass over the plateau, and are there precipitated in the form of thunder-showers. It is probable that these thunder-showers accompany low-pressure systems, and it is possible that these low-pressure systems may travel eastward from Natal. It has been confidently asserted that rain in the Transvaal can be readily predicted from Natal. I am inclined to think that this may be the case, at any rate towards midsummer. At this time of the year the ordinary eastward travelling depressions of cold countries are very weak, even in Cape latitudes, and it is quite conceivable that they do not, at that time of the year, have any influence on the weather of the Transvaal; while, on the other hand, Meldrum's diagrams show several tropical cyclones travelling westward from Mauritius to the African coast, then bending south and curving round to the easterly storm-track of more southern latitudes. The Isidenge tornado of 1886 and the stormy weather in the south-east of Cape Colony was connected with disturbed weather at Mauritius.

These and other questions will be cleared up by the Meteorological Department now established in the Transvaal.

TRANSVAAL WEATHER CHEAPENS TREE-PLANTING.

The short two months' winter of the Transvaal (inplace of the three or four months of winter at the Cape) and the summer rains have the effect of shortening and facilitating nursery work and tree-planting. At the Cape sowing is done in September; the young trees remain in the nursery all the summer and are planted out the following winter. In the Transvaal seed is sown in July and August, and the young trees are often ready to plant out with the heavy rains of January or February. The monthly distribution of rainfall is shown in the following table:—

RAINFALL—NINE YEARS' MEAN—PRETORIA.

	Inches.
July	0
August	0
September	1
October	1¾

	Inches.
November	3¾
December	4½
January	7
February	4
March	2¾
April	¾
May	½
June	0
Year	26·53

The heaviest recorded rainfall was in February. During June, July, and August the monthly average is under ½ inch. In Johannesburg the distribution is the same, the totals being slightly in excess. Mean yearly rainfall, Johannesburg, 28 inches.

With water, planting may be done in winter, but the rainy season in summer is the natural and best season, and the only one feasible for planting on a large scale.

RADIATION AND NURSERY WORK.

The winter nursery work of the Transvaal requires, however, to be carefully protected against radiation—the scorching sun by day, the blistering frosts by night. On an inland plateau, with the dry clear air of the dry season, radiation must necessarily be very active. The protecting moisture of more temperate climates can be supplied in Transvaal tree nurseries by protective lathe structures, such as are used by nurserymen for delicate plants in all climates. The trying effect of the Transvaal radiation is noticeable in the cultivation of many Japanese plants. In their own moist climate they withstand severe frost and snow, while the 10 or 12 degrees of frost at Johannesburg kills them to the ground.

COUNTRIES THAT WILL SUPPLY TREES FOR THE TRANSVAAL.

Naturally at first sight it would seem that the trees best adapted to the country are those already growing in it, and, with limitations, this is true. But the limitations are such that for the production of the timber most wanted and for quick-growing ornamental trees we must look to foreign countries, with their larger, stronger forest floras. From countries having climates similar to the Transvaal we are able, while rejecting a number of comparatively worthless trees, to select a few which are capable of producing the class of timber now imported to the Transvaal.

We may pause a moment and enquire what is the wood most required in the Transvaal. Extra-tropical timbers may be divided into the following four classes :—

(1) Durable softwood.
(2) Perishable softwood.
(3) Durable hardwood.
(4) Perishable hardwood.

The comparative value of these timbers for general purposes is as they stand on this list. Durable softwoods comprise the Cedars and all durable woods not harder than teak. Perishable softwoods comprise the Pines, quite good enough for ordinary house-building purposes, but not good enough where White-ants are troublesome. For durable hardwoods there is still a good demand for certain uses, such as fencing posts and sleepers.

Perishable hardwoods, unfortunately, comprise the bulk of the timber in most extra-tropical and tropical forests, and hence the comparative valuelessness of such large areas of these forests. Indeed, it is often a question whether, before starting cultivated forests of the right sort, the presence of previous forest is an advantage or not. To take a case in point, the Teak forests of India average about one or two Teak trees per acre, the remaining timber being composed mostly of comparatively worthless hardwoods. Indian Foresters are hoping to gradually improve the proportion of Teak in these forests by regulated cuttings. But the Dutch Foresters of Java consider it more economical to entirely cut down the poor natural Teak forest and replace it by plantations of pure Teak. Hence it is, perhaps, easier for the Transvaal to lay down an economical valuable forest of the right species on ground where there at present exists no forest than to have to do so on ground occupied by economically inferior forests. But before embarking on an enterprise of this sort we have to be quite certain of two things : (1) the class of timber we require, and (2) that the trees selected to produce it are climatically fitted to the country.

On looking abroad around the world, we see that the following countries are best fitted to produce the timber required by the Transvaal :—

Mexico.
China and Japan.
The drier Himalayas.
Australia.
The Argentine.

I shall now touch briefly on each of these and their trees.

MEXICO.

Temperate Mexico is represented by a plateau in the same latitude, but of somewhat higher elevation than the Transvaal. The lower portions of the plateau of Mexico have elevations similar to those of the Transvaal, and a heavy rainfall brought by the North-east Trade wind, corresponding to the heavy rainfall brought by the South-east Trade to the eastern side of the Transvaal plateau. It is in the Wood-Bush Range and along the eastern edge of the Transvaal plateau, therefore, that the best Mexican trees are likely to show the finest growth. The higher Mexican elevations can only be reached in temperature and rainfall on certain Transvaal mountain tops. The planting of these will depend naturally on their accessibility. I understand that there are a considerable number of such sites along the eastern Transvaal border. It should be noted that in the same latitude, and for the same altitude, temperatures are 2 or 3 degrees lower in the Transvaal than in Mexico; thus, 5,000 feet in the Transvaal would correspond with 6,000 feet in Mexico.

Mexico gets its rains on the eastern side directly from the North-east Trade wind; on the western side, indirectly, the North-east Trade wind being deflected landwards with a monsoonal effect when the sun is at its zenith. Thus the rain is heavier and lasts longer on the eastern or Atlantic than on the western or Pacific slope; in fact, on the mountains of the eastern side the rains last for nine months, and there is no real dry season, since even in winter, when the dry northerly winds are blowing, this portion of the country is bathed by frequent mists. Here we have the parallel of the Wood-Bush Range in the Transvaal. The forest on the Atlantic slopes of Mexico is dense and characterised by evergreen oaks, of which Liebmann distinguished 20 varieties on Orizaba. Altogether, 80 species of Mexican Oaks have been described, of which nearly the whole are endemic to Mexico. The evergreen Oaks are found at the lower elevations, the leaf-shedding Oaks at the higher elevations.

On the western slope there is none of the dense forest and heavy vegetation characterising the eastern slopes, but, curiously, the temperate forest zone descends here lower than on the eastern side, though the climate is drier and warmer. (It is warmer (1) because there is less cloud and rain, (2) because the Trade winds, after passing over the mountains and plateaux, descend to it as warm dry winds.) Thus Conifers, which, according to Humboldt, are not seen lower than 5,700 feet on the eastern side, are seen at 3,000 feet on the western side, while on the western side Oaks descend to 2,000 feet.

The average elevation of the great plateau of temperate Mexico is from 6,000 to 8,000 feet. It enjoys an equable climate, there being a difference of only 14 degrees between the warmest and coldest months at Mexico City (7,391 feet elevation, mean temperature 60 degrees). This may be compared with 14·25 degrees, the difference for the Cape Peninsula, and 20 degrees for Johannesburg.

Rainfall.—The rainfall on the Mexican plateau varies according to elevation and aspect. Generally, Northern Mexico is dry, Southern Mexico wet, while the driest part is an inland strip running north of Mexico City. Northern Mexico has a general average of from 20 to 30 inches rainfall. In the dry central strip the rainfall is under 20 inches, while in Southern Mexico it runs up to 60 and 80 inches on the plateau, and higher still on the coast. Mexico City has a rainfall of 26 inches and Oaxaca with its great Cedars (*Taxodium mucronatum*) has 28 inches, while the Mountain of Orizaba, with its forests of Oak and Pine, has a rainfall of 78 inches.

Wooded kloofs, termed "Barancas," traverse the plateaux and mountain ranges are seen in every direction. The highest and most inaccessible of these are well wooded. Oak and Pine are the chief species, but several fine Cedars are abundant. *Juniperus flaccida*, *J. occidentalis*, and *J. pachyphloia* abound in the north-east, sometimes forming pure forest, while *J. mexicana* is widespread. *Taxodium mucronatum* occurs in the southern, better-watered districts.

Of Conifers it is reckoned that there are 20 species. The highest mountain slopes from 6,000 to 12,000 feet are occupied by Conifers.

On the Peak of Orizaba we have the Mexican Silver-fir, *Abies religiosa*, occupying a clearly marked zone between 9,000 and 11,000 feet, and above this, at a higher elevation still, *Pinus montezumæ* and *Pinus hartwigii*.

As regards the lower limit of the Mexican Pines, *Abies religiosa* is found near the City of Mexico and *Pinus oocarpa* on the slopes of the Jaruloo Volcano at an altitude of only 2,000 feet (Fournier).

Trotter, writing in 1903, estimates the forests of Mexico to cover an area of 25 per cent. of the total surface.

CHINA.

The portion of China most resembling the Transvaal seems to be the Yu-Nan plateau, lying to the north-east of Burmah. According to Dr. Nisbet, an Indian Forest Officer ("Burmah under British Rule"), Yu-Nan is a high, dry plateau strikingly like the Transvaal in many

respects. The average elevation is from 5,000 to 8,000 feet. Other accounts speak of considerable Pine forests in this locality. Dr. M. T. Masters, in the Index Florae Sinensis, enumerates 8 good timber species of Pine and 29 other Conifers growing in Yu-Nan, Korea, and the middle latitudes of China. Dr. Henry found that interesting tree, "*Belis jaculifolia*," growing wild in Yu-Nan. *Podocarpus chinensis*, or Chinese Yellow-wood, is another good Yu-Nan tree. Yu-Nan, it may be mentioned, is credited with a population of 5,000,000, or 51 to the square mile, and it is said to be richly mineralised. As in the Transvaal, maize is the chief crop.

A few trees from other portions of China are mentioned on my list. Speaking generally, however, the coast of Southern China is too tropical for the Transvaal, and Northern China too cold. There is, however, an area along the middle of China, especially the mountains of Western China and South Korea, with cold dry winters and good summer rains, where the climate approximates more closely to that of the Transvaal in nearly the same latitude, the difference lying in the seasonal range of temperature—the colder winters and wetter warmer summers in China.

JAPAN.

I have entered Japanese trees with some hesitation, and on the ground more of their excellence than of any general fitness for the Transvaal. Japan has a plentiful all-the-year-round rainfall, and a high range of temperatures. Its conditions are distantly imitated only on a few mountain ranges of the Transvaal, such as the Wood-Bush Range, where mist and occasional showers preserve moisture in the ground all the year round. A certain number of Japanese trees, too, extend to the drier parts of middle China, where climatic conditions more resemble the Transvaal, namely, quite dry winters and heavy rainfall in summer. Naturally in all such cases, though the tree may grow in Japan as well as in China, seed for the Transvaal should be sought from China.

It may be worth noting that the typical forest distribution as seen on Fusiyama, latitude 36 degrees, is as follows:—

Sea level to 2,600 feet.—Beach, Maple, Ash, with some Conifers, such as *Cephalotaxus drupaceæ*.

2,600 to 6,000 feet.—Region of noble Conifers—Pines, Silver Fir *Abies firma*, *Tsuga sieboldii*, etc.

6,000 to 8,000 feet.—Japanese Larch, *Larix leptolepis*.

8,000 to 12,000 feet.—Alpine region with dwarf Conifers.

Of the 36 species of Japanese Conifers, 12 occur also in China.

HIMALAYAS.

Himalayan trees are less generally well adapted to the Transvaal than those of Mexico. There is little plateau country on the Himalayas, and care must be taken in selecting Himalayan trees for the Transvaal climate to choose those only from the drier Western Himalayas and the drier inner Himalayas. The Eastern Himalayas have a very heavy tropical rainfall, and to introduce trees from there to the Transvaal would, in most cases, lead to disappointment. Happily, however, the most valuable timber tree in the Transvaal, the Deodar, grows, not in the dense heavy-rainfall forests of the Eastern Himalayas, but on the comparatively dry western side. The Deodar is already growing well in the Transvaal, and so far as one can see it is likely to become the chief timber tree in the Transvaal forestry of the future. With the Deodar is associated *Pinus longifolia* and some other trees of lesser value, which are briefly described in my list. The Western Himalayas have a slight winter rainfall, a dry spring, and a heavy summer rainfall; while elevations and latitudes can be obtained the same as those prevailing in the Transvaal. In Afghanistan and the extreme west of the Himalayas the summer monsoon scarcely penetrates. Thus Quetta has a slight rainfall falling entirely in winter.

AUSTRALIA.

Many Australian trees have been grown in the Transvaal, but with varying success. There is no plateau country in Australia at all equal in elevation to the plateau country of the Transvaal or temperate South Africa. Australian trees can, therefore, only be grown in the Transvaal on the condition of altitude compensating for latitude. How far this compensation applies in the case of each species can only be ascertained by test-planting. We see certain Australian trees which seem to succeed to perfection in the Transvaal; we see others which fail in a most disappointing manner. It is winters with exceptionally severe frosts which test the fitness of the low level

Australian trees on the high Transvaal plateau. Australian trees are likely to give the best results in the north-east of the Transvaal, where there is little or no frost and the heavy rainfall approximates to the coast rainfall of the coast mountains of East Australia. Thus many Australian trees which would succumb to frost in Johannesburg or Pretoria would succeed on the Wood-Bush Range. It is noteworthy that on the Wood-Bush Range we have about 60 square miles of practically the same forest as is found at sea level on the south coast of Cape Colony, altitude here completely compensating for latitude.

The New England plateau is the part of Australia which is best adapted to supply trees for the Transvaal, and in writing to Queensland or Northern New South Wales for trees, seeds should be obtained, if possible, from the New England plateau. A seed collector at Tenterden would be useful, and might for some years be given constant employment remitting fresh seeds, as he collected them, by post. I have for some time had a collector in West Australia supplying me with seeds in this way, but there is now little left for him to send, nearly all the valuable West Australian trees already producing seeds in the Cape plantations.

Professor J. H. Maiden, Government Botanist, New South Wales, enumerates the following Eucalypts as growing on the New England plateau. He draws attention to the peculiar occurrence of some of the southern species on this table-land. These and other southern species have winter or all-the-year-round rainfalls, and the New England plateau often marks their extreme northern limits .—

Eucalyptus stellulata.—A gum of no timber value, fairly plentiful all over the table-land.

Eucalyptus coriacea.—Called White Ash in New England ; a second-rate timber tree useful for some purposes.

Eucalyptus regnans.—This is the giant gum of Victoria, reappearing in a smaller form.

Eucalyptus amygdalina, var. radiata.—Not very abundant, but remarkable for its profuse flowers.

Eucalyptus obliqua.—Maiden found a fine forest of these trees, with trunks 3 feet and more in diameter and over 100 feet high ; their occurrence here was quite unexpected.

Eucalyptus eugenioides.—Called "Red Stringy Bark" here, and used for flooring boards.

Eucalyptus melliodora.—A large-fruited form, with well-defined rim; not very abundant.

Eucalyptus stuartiana.—Very abundant and showing various forms. "New England," says Professor Maiden, "may be called the Stuartiana country."

Eucalyptus viminalis.—A fine forest of these trees with diameters up to 3 feet and height of 100 feet, on rich basaltic soil. Maiden notes (as I have noticed in the Transvaal) that some of these trees are strikingly smooth and others rough barked. *E. viminalis* is abundant on the New England plateau.

Eucalyptus tereticornis.—Fine trees; though common on the mountains near the coast, it was not abundant on the table-land.

In Australia the best timber grows on the coastal belts and on the coastal mountains. On the plateau country above the mountains, going west, as the rainfall diminishes, many of the most valuable Gums disappear, leaving, however, the Iron-barks, the chief being Eucalyptus crebra and the so-called "Box" Eucalypts. Going towards the north-west the Iron-barks become mixed with Callitris. Going further west, there is a large area in which are found scrubby forests of Callitris and Box, and further west still, over the Darling River, stunted Eucalypts, Casuarinas, and Acacias.

Callitris verrucosa and *Callitris calcarata* are the two chief trees of the interior plateau country of New South Wales, where they cover huge areas, to the despair of the squatter, who seeks to destroy them by burning in order to get more grass for his flocks. After burning, however, the Cypress-Pines come up in such dense thickets that it is difficult to keep them down. The best trees are produced when the dense thickets are thinned artificially, so as to throw the scanty sub-soil moisture into a lesser number of stems.

ARGENTINE

(AND ABYSSINIA).

On the Andean slopes of the Argentine is a strip of country reproducing the Transvaal in rainfall, latitude, and elevation; and parts of the Gran Chaco forest country,

lying at a lower level, will produce trees for the Western Transvaal and for the lower portions of the plateau about the elevation of Barberton. The most valuable trees from this portion of the Argentine have, therefore, been included in my list, though more information is required with regard to their requirements and quality, and in some cases even the botanical name is wanting.

There are a few Abyssinian trees that may be worth while introducing to the Transvaal. The rains are the same in both countries, but the latitude of Abyssinia lower. It is difficult or impossible to procure seed from Abyssinia.

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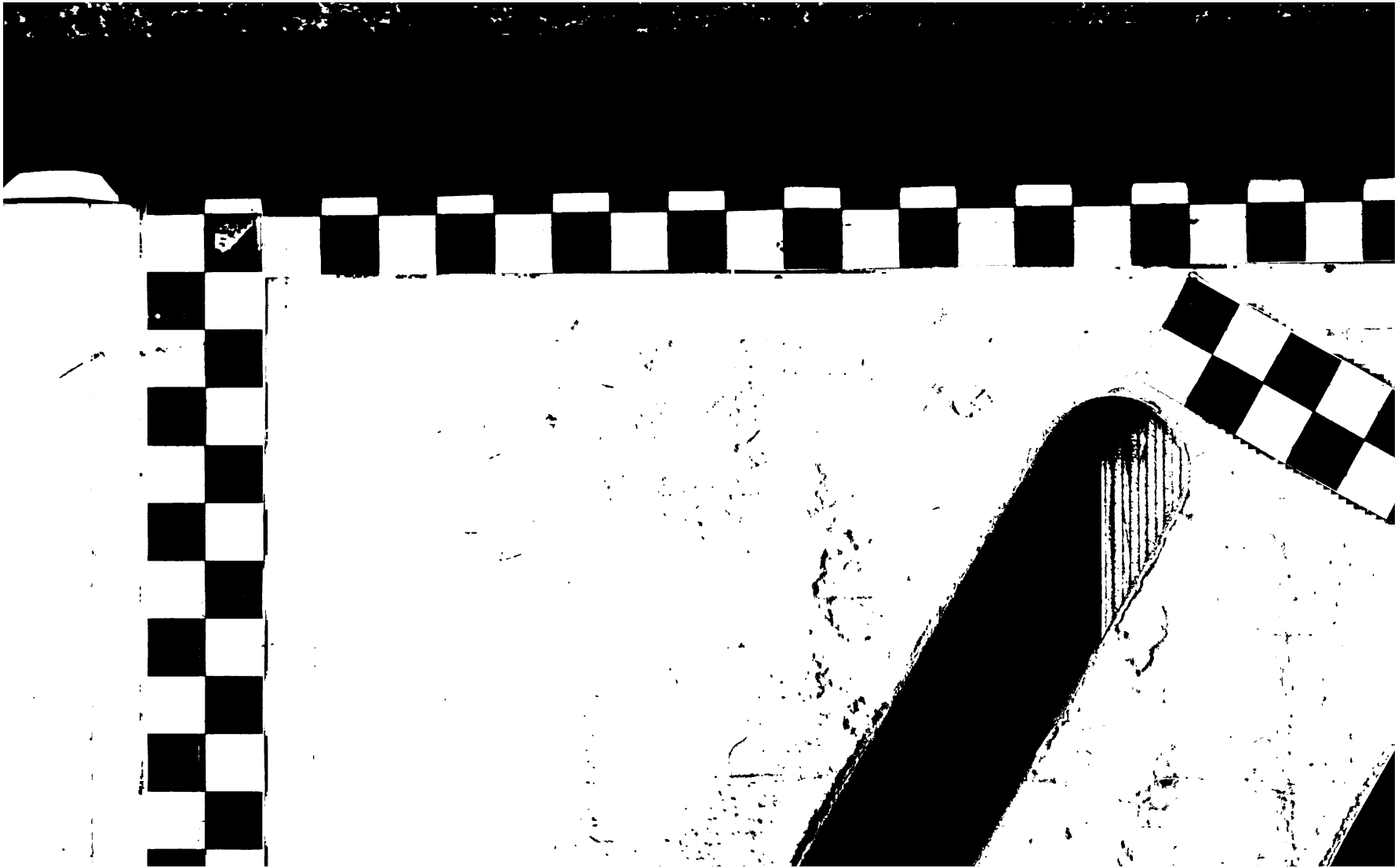
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